PUBLIC WORKS

City, County and State

September, 1961

Cooperation which provides better transportation facilities is typified by the teamwork of Glenn C. Richards, right, Commissioner of Public Works for Detroit, and Joseph W. Gross, Wayne County Highway Engineer. They are shown standing over the entrance to an expressway tunnel beneath Detroit's Convention Hall. More on page 18.

In BUENA VISTA, VIRGINIA

TYLOX®

Rubber
PIPE GASKETS

- √ REDUCE PIPE-LAYING COSTS
- √ MAKE WATER-TIGHT JOINTS
- √ WHIP ACID ATTACK

Coupling TYLOX-Gasketed pipe is as fast as the few seconds required to shove pipe home into the line. Mud and water, as shown here does not slow up the work, or affect the compression seal.

Here's how . . .

TYLOX Gaskets "snap on" to pipe tongues in seconds . . . merely shoving the pipe home completes the joint. Being *flexible*, TYLOX compensates for pipe angularities, mud and water doesn't slow up coupling work, and laid line can be backfilled immediately. Construction costs are substantially reduced.

TYLOX Gaskets have seven sealing ribs that "pack" the annular space tight as pipe is coupled. A true *compression*, yet flexible seal is formed which prevents leakage of water *in* or *out* of the joints. Natural resilience of the TYLOX rubber keeps the seal water-tight. Root and sediment problems are prevented, and sewage treatment costs are reduced.

TYLOX Gaskets are made of rubber specially compounded for immunity to sewage and industrial waste acids and alkalies. Under ground and under compression, they outlast the life of the pipe itself.

SEND FOR ENGINEERING DATA AND ILLUSTRATED CASE HISTORIES ON TYLOX RUBBER PIPE GASKETS

* **PROJECT:** City of Buena Vista, Va., trunk line to sewage treatment plant.

ENGINEERS: R. Stuart Royer & Associates, Richmond, Va.

CONTRACTOR: English Construction Co., Alta Vista, Va.

PIPE: TYLOX-coupled T & G in 15" to 24" diameters, manufactured by Roanoke Concrete Products Co., Inc., Roanoke, Va.

5123-3

HAMILTON KENT
MANUFACTURING COMPANY
KENT, OHIO
427 West Grant Street . Orchard 3-9555

NORTHWEST: Seattle 1, Wash., MUtual 2-7667 • CANADA: Cooksville, Ont., ATwater 9-3671

from "Chicago"

A SMALL COMPACT 4 inch COMMINUTOR

Reverse cutting 4R Comminutor for packaged sewage treatment plants and pump stations.

The NEW 4R Comminutor screening and comminuting machine, smallest (25" high with 4" drum) of those manufactured by Chicago Pump is a self contained unit with stainless steel cutting teeth and comb. This new reverse cutting concept of comminution provides increased sewage solids cutting capacity. The cutting teeth, driven by a ¼ hp motor automatically cuts all solids in the sewage inlet line. The unit with its adaptable mounting fits any inlet line and can be easily removed without pipe disturbance.

Write for Bulletin 184

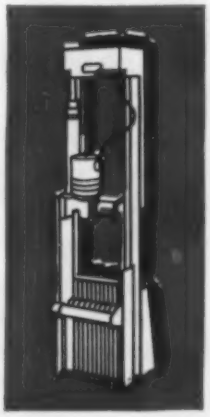
LARGER COMMINUTING MACHINES

THE ORIGINAL COMMINUTOR

The original Comminutor, developed by Chicago Pump provides continuous screening and cutting of coarse sewage matter for use in hydraulically designed feeder basins. Sized for flows of .175 to 25 MGD per machine.

MODEL "C" BARMINUTOR MACHINE

Model "C" Barminutor—reversible screening and comminuting machine for channels 1 to 3 feet wide. Outstanding features include single motor drive counterweighted for extended life, stainless steel screen, ball bearing shoes and reversible cutting for increased cutting action and cutter life.



Putting Ideas to Work

FOOD MACHINERY AND CHEMICAL CORPORATION

HYDRODYNAMICS DIVISION

CHICAGO PUMP

622F DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

Special report to users of Caterpillar equipment:

CAT CATERPILLAR

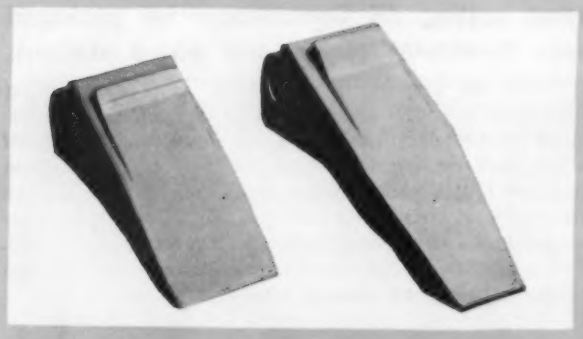
Parts you can trust
...cost less per hour

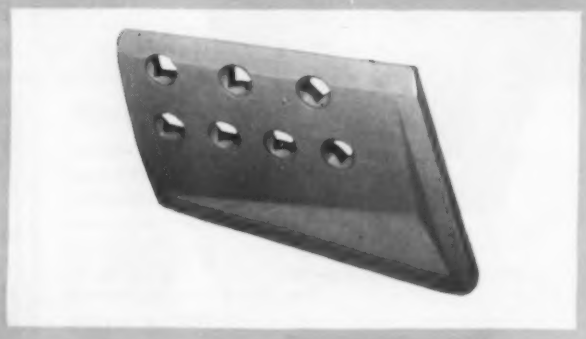
New Cat No. 8 and No. 9 Ripper Tips outproduce other brands 25 to 50% in field tests

That's the kind of news you can use—to cut costs. This newcomer to the Caterpillar line of ground-engaging tools is making a name for itself with cost-conscious users.

They're exceptionally wear-resistant—hardened to Rockwell C50 for longer wear-life under any conditions.

Check the price! Improved Cat Tips sell for about the same *or even less* than other leading brands.





They're available in two new designs. Both the short and long tips shown in the photograph are *self-sharpening* to keep their working edge until replacement. The long tip gives extra wear-life with only a slight reduction in impact strength. Low-cost, weld-on shank adapters are available for *all brands* of shanks. No need to wait—you can put these new Cat Tips on your job immediately.

In field tests the short tip was pitted against two leading brands on rippers working in caliche and cemented conglomerate beds. The Cat Tip outproduced the other brands 25-50%—representing savings of 38-54% in replacement costs.

Outstanding impact strength! One No. 9 Tip, tested in *solid* granite, took 13 smashing blows from another D9 pusher that backed up 10 feet before each charge at the stalled D9 Ripper.

And here's another money-saving newcomer—Cat's new No. 7, No. 8, No. 9 End Bits are redesigned for better digging ability. They self-sharpen as they wear away for continuing like-new performance. They're forged alloy steel and heat treated for outstanding strength and wear-resistance.

Compare other ground-engaging tool brands against the Caterpillar line. Keep machine-hour records and find out for yourself which is the best buy. Those who do, buy Caterpillar.

See your Caterpillar Dealer for the best in parts and service.

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

CATERPILLAR

Diesel Engines • Tractors • Motor Graders • Earthmoving Equipment

PUBLIC WORKS

THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES

SEPTEMBER, 1961 • Volume 92, Number 9

READERSHIP Eastman RESEARCH

Established 1896
Public Works T. M. Reg. U.S. Pat. Off.

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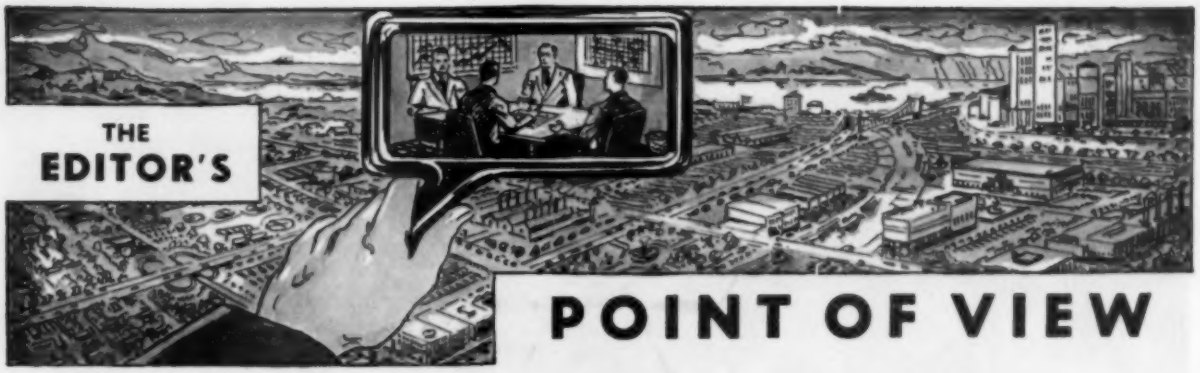
BPA

PUBLIC WORKS JOURNAL CORP.
200 So. Broad St., Ridgewood, N. J.



THE EDITOR'S POINT OF VIEW

National Public Works Week

ONCE A YEAR most everyone gets around to a week of recognition and even honor for the oft-forgotten men who, all the year around, construct, maintain and operate our public works. These are the men who keep the water flowing to countless homes; provide sewers to carry away waste and storm water; maintain our streets and highways and clear them of snow; pick up and dispose of our solid wastes; and provide many other services without which modern life would be impossible. These men are richly due a far greater degree of recognition than they will ever get; but it is nice to see even a week—October 1 to 7 this year—during which the communities they serve will accord them the honors too often going to others.

It is our hope that in every community an active program will be conducted by the press and by local radio and television stations to increase the public's awareness of the faithful but often little-appreciated work that is performed daily in their behalf by their municipal employees.

Training for Operators of Water and Sewerage Systems

SHORT SCHOOLS and other devices for training water and sewage works operators have improved greatly in recent years and some of them have done a great deal of good. The benefit has often been a dual one in that better operation has resulted and the economic status of the operators has been improved. Though it is apparent that, in many places, a technically trained man is not needed, we believe that in every state there are a number of works that would benefit from engineering skills. In few fields of sanitary engineering, we believe, has progress in utilizing engineers been slower. A study of the needs for engineers and a quite precise analysis of the work they could and should do in a few of the communities in each state would be valuable. This is a job that ought to be done by the state sanitary engineers but also might be performed by a water or sewage works section or association. Whoever does it, the results would certainly be interesting and might open some new doors of opportunity while providing also better services to the taxpayers.

Labor Cost vs Capital Expenditures in Sewage Treatment

IN A DISCUSSION of papers at a sewage treatment conference in England, it seemed to be an opinion that a capital expenditure of $33,000 to $42,000 would be justified to reduce labor requirements in operation by one man. In view of the low labor costs in England, as compared to those in this country, this is extremely interesting and brings up the question of how much capital expenditure would be justified here on the same basis. At any rate, no designing engineer can afford to overlook or fail to give consideration to the many excellent devices now available for reducing manpower operational requirements.

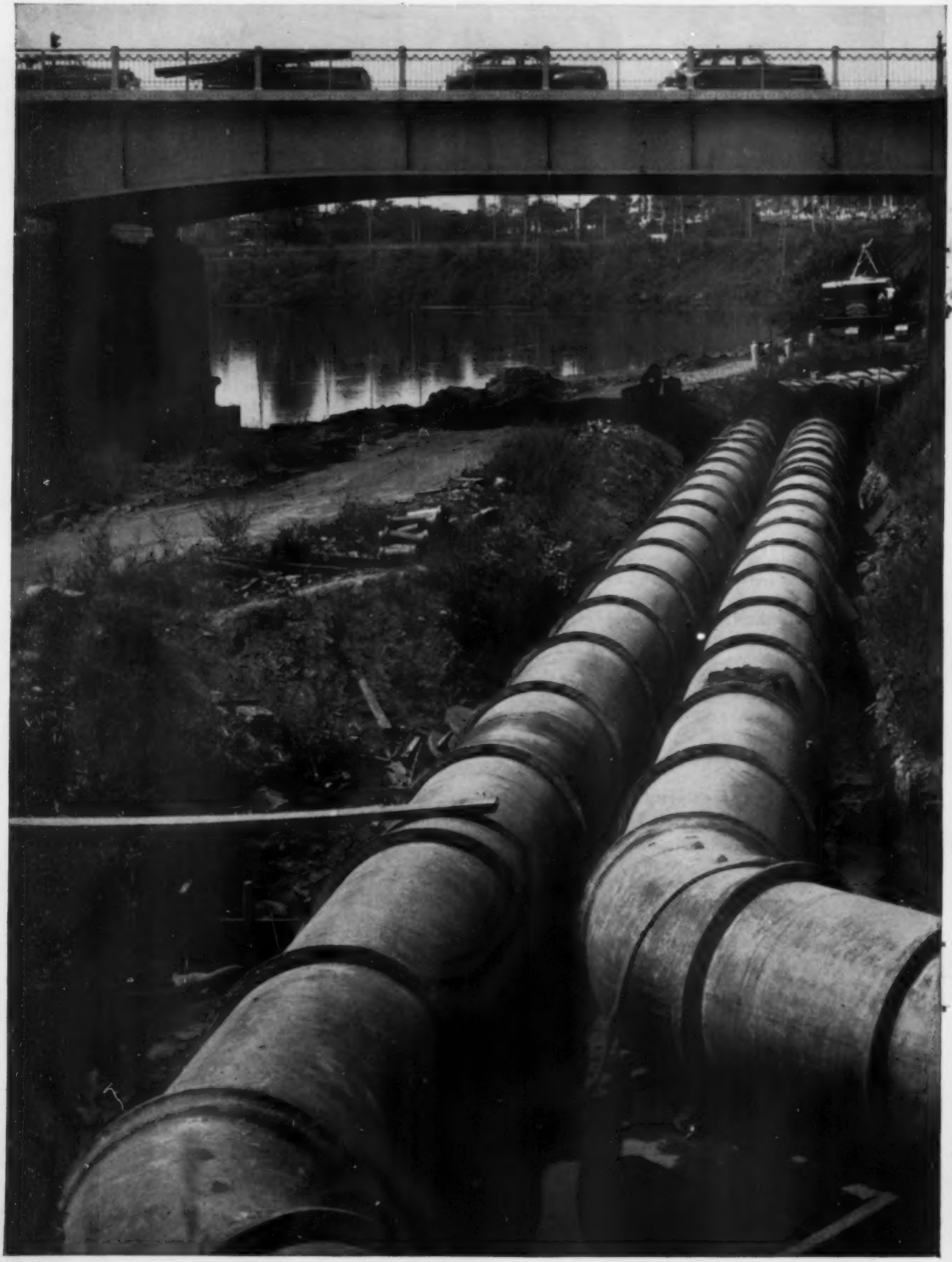
We would be glad to have our readers comment on their experiences and observations regarding this problem of capital vs operating expenditures.

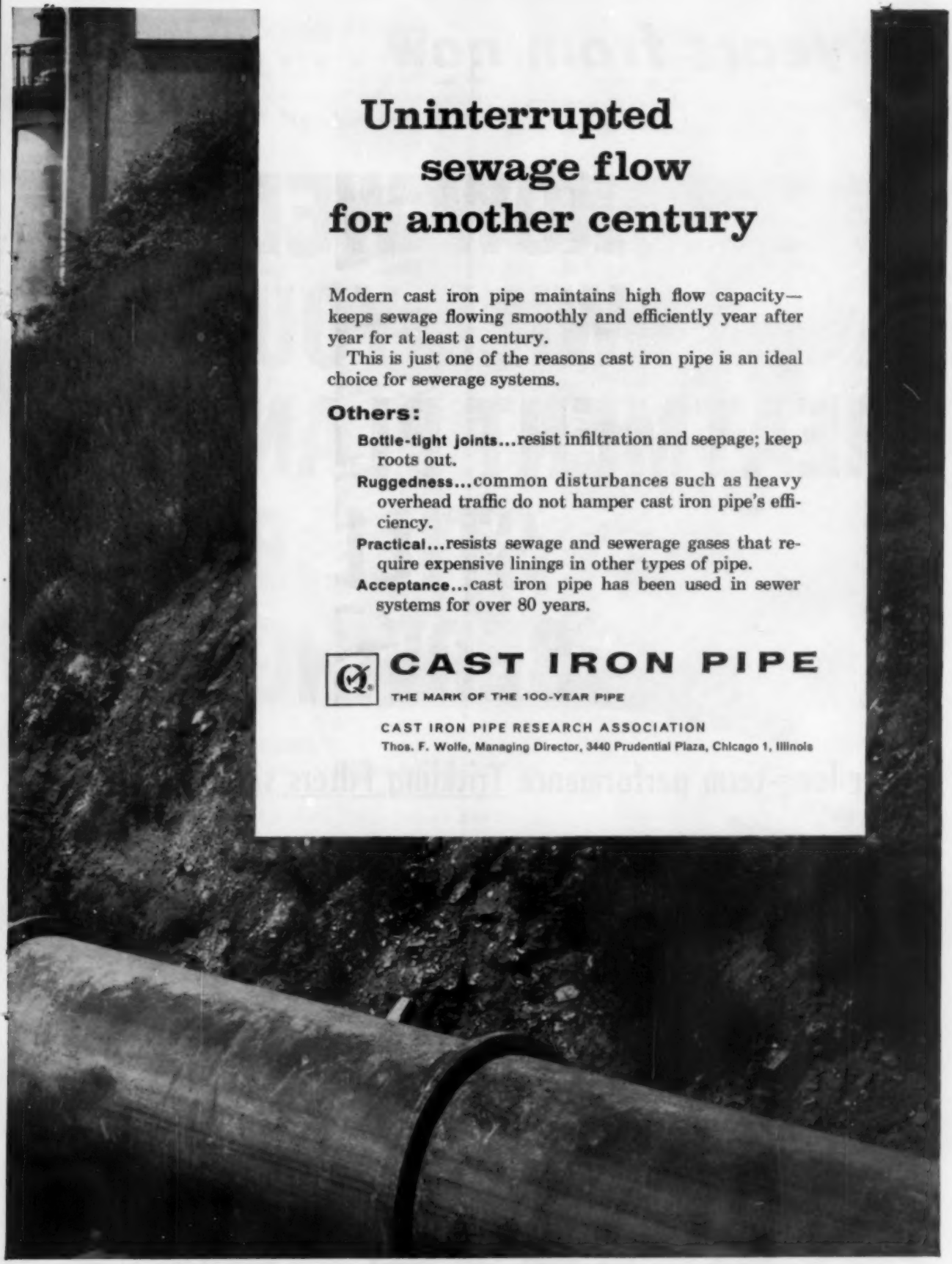
Furthermore, we would like to emphasize that maintenance and repairs can cost a great deal of money; and that fullest consideration ought to be given to the use of the best possible equipment, even when the initial cost is higher, to the end that the longest service life is obtained at the lowest overall cost.

New Ideas are Needed in Refuse Collection and Disposal

THE COLLECTION and disposal of refuse is one of the more costly municipal activities. A necessary municipal function for many years, it is new becoming equally necessary in many formerly rural sections. Just as soon as an area becomes so built up that pigs and chickens can no longer be kept and outdoor burning of refuse is not feasible, some sort of collection facilities must be provided. Since refuse is one type of material that gets worse the more of it you have in one place, disposal is an inevitable problem.

How to reduce the cost and improve the quality of collection while simplifying disposal is one of our big problems. The money involved in day to day collection and disposal justifies extensive search for new ideas and for better methods and equipment. A start is being made and this is all to the good. Every city should support every effort that promises to solve or even to mitigate the problem.





Uninterrupted sewage flow for another century

Modern cast iron pipe maintains high flow capacity—keeps sewage flowing smoothly and efficiently year after year for at least a century.

This is just one of the reasons cast iron pipe is an ideal choice for sewerage systems.

Others:

Bottle-tight joints...resist infiltration and seepage; keep roots out.

Ruggedness...common disturbances such as heavy overhead traffic do not hamper cast iron pipe's efficiency.

Practical...resists sewage and sewerage gases that require expensive linings in other types of pipe.

Acceptance...cast iron pipe has been used in sewer systems for over 80 years.

CAST IRON PIPE

THE MARK OF THE 100-YEAR PIPE

CAST IRON PIPE RESEARCH ASSOCIATION

Thos. F. Wolfe, Managing Director, 3440 Prudential Plaza, Chicago 1, Illinois

30 years from now . . .

HOW WELL WILL YOUR TREATMENT PLANT STILL BE SERVING?

For long-term performance Trickling Filters serve best!

To end stream pollution, more and more trickling filters are being built . . . more than any other type.

A big reason for preferring them for treating both industrial wastes and domestic sewage is that on the basis of past performance many trickling filters will still be operating as well 30 years later as when first installed. No other type is easier to add to if growth exceeds original estimates.

Trickling Filters have long since earned a high place in engineers' regard by their combination of these 6 advantages:

TFFI

1. Low cost, initially and in operation
2. Simple easy operation, minimum man-power
3. Long life, outlasting bonds issued
4. Good results. Top notch effluent
5. Reliable performance
6. Over-loads are no problem

AN ORGANIZATION OF MANUFACTURERS

The best Trickling Filters

Have floors of TFFI Specification vitrified clay underdrain blocks. The most vital part of trickling filters is the underdrain system. Failures here spell real trouble later. But when the floor is of TFFI Specification vitrified clay blocks this is guarded against. It is inherent in clay to resist successfully the ravages of acids, alkalis and bacteriological action. TFFI clay blocks are made in modern plants under rigid controls of quality that no substitute material can even approach.

Lowest final cost

Final cost is true cost, and with clay you are assured that first and final cost will be one. For clay continues to be your best insurance against costly future failures that can destroy many times over any "savings" made by using less than the best.

Demand CERTIFIED Underdrain Blocks

Vitrified Clay Block manufactured by TRICKLING FILTER FLOOR INSTITUTE members and tested by the Materials Testing Laboratory of Rose Polytechnic Institute comply with or exceed ASTM Specification C 159-59T. **Only TFFI blocks give you a 50-year Guarantee.**

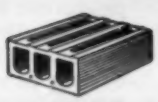
DICKEY
W. S. Dickey Clay Mfg. Co.
P.O. Box 2028
Kansas City 42, Mo.

TRANSLOT
Texas Vitrified Pipe Co.
Mineral Wells, Texas

NATCO
Natco Corporation
327 Fifth Avenue
Pittsburgh 22, Pa.

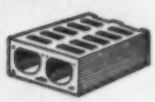
Trickling Filter Floor Institute

TRANSLOT
Cannelton Sewer Pipe Co.
Cannelton, Indiana



POMONA
Pomona Terra-Cotta Co.
Greensboro, No. Car.

ARMCRE
Ayer-McCarel Clay Co., Inc.
Brazil, Indiana



BOSCO
Bowerston Shale Co.
Bowerston, Ohio

DEDICATED TO FURTHERING THE RESEARCH, DEVELOPMENT AND IMPROVEMENT OF VITRIFIED CLAY UNDERDRAINS FOR TRICKLING FILTERS.

Built to take the load off

For years INTERNATIONAL TRUCKS have been proving how little *first cost* means for shrewd municipal buying. *Truck-built* by a *truck manufacturer,* they survive administration after administration—saving civic dollars.

The new, do-anything SCOUT® whips out with the crew, the superintendent, the tools, the special equipment, on the road or off. Only 67-in. high, 68-in. wide, it seats 3 in front, gives you a 5-ft. pickup box in back. New "slant-four" COMANCHE engine by INTERNATIONAL delivers 93 hp., saves gas. Options include winch, snow-plow and pusher-bumper, as well as power at the rear to drive any number of other attachments. Order your SCOUT with standard steel cab top or fully-enclosed TRAVEL-TOP. Also soft vinyl Sport Tops for cab and full enclosure—and all tops are removable. All-wheel-drive model also available.

the taxpayer's back

Councilmen, city engineers, equipment superintendents—they'll all tell you that INTERNATIONAL Trucks have *written themselves* into your specifications—written them in with the enduring service they have given over the years. Whether you are moving fill or shooting out to answer emergency calls, INTERNATIONAL gives you the trucks with *the performance*. They're always on call, seldom out of commission in the city garage.

And the INTERNATIONAL line is as broad as the duties it is asked to perform. There is a perfect truck-match for every civic hauling need, in GVW ratings from 3,200 all the way up to 73,000 lbs; in gasoline, diesel and LPG power; in 4, 6 and V-8 cylinder engines. When working out specifications for your next bid, you'll save a lot of money by first consulting your nearby INTERNATIONAL Dealer or Branch. International Harvester Co., Chicago.

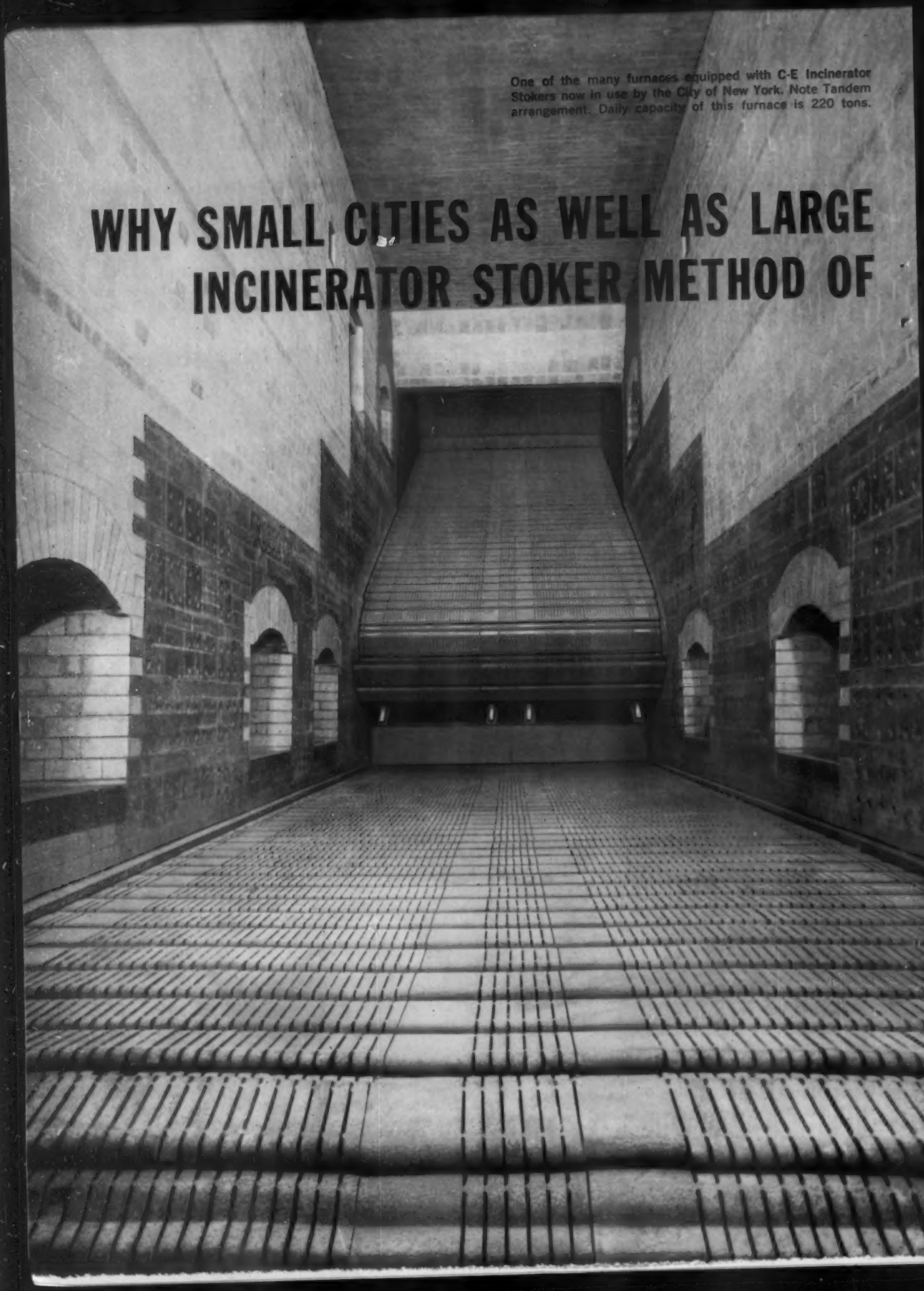
The easy-loading feature of the low-height body on this INTERNATIONAL all-purpose dump truck —Model C-130—lends itself to solving a wide variety of civic hauling problems. Frame and chassis are built to work with hydraulic equipment. Available with 4-speed or automatic transmission, or with stake or platform bodies. GVW rating up to 8,800 lbs.

Don't miss the INTERNATIONAL EXHIBIT at the PUBLIC WORKS CONGRESS in Minneapolis

You are also invited to drop around to the INTERNATIONAL hospitality suite, Hotel Leamington, September 24th-27th.

INTERNATIONAL® TRUCKS

WORLD'S MOST COMPLETE LINE



One of the many furnaces equipped with C-E Incinerator Stokers now in use by the City of New York. Note Tandem arrangement. Daily capacity of this furnace is 220 tons.

WHY SMALL CITIES AS WELL AS LARGE INCINERATOR STOKER METHOD OF

PREFER THE C-E REFUSE DISPOSAL

Cities of all sizes use C-E Traveling Grate Incinerator Stokers. New York, for example, uses 30 C-E Incinerator Stokers with a total daily capacity of 3,660 tons. New Albany, Indiana (population about 25,000), uses 2 C-E Stokers with a daily capacity of 160 tons.

Refuse becomes clinker-free, sterile ash

C-E Incinerator Stokers are expressly designed for the rapid, complete and continuous processing of mixed combustible refuse typical of most communities. Refuse is transformed into clinker-free, sterile ash – ideal for land fill.

Cuts maintenance and operating costs

City administrators also find that C-E Incinerator Stokers cut operating and maintenance costs. Only minimum maintenance is required from the time refuse is dumped into the hopper until residue is ready to be hauled away. Man-hours for operation and maintenance per ton of refuse are lower than for any other burning method. Availability of the equipment is very high.

We'll gladly consult with you as to the arrangement best suited to your community's needs. Please address your inquiry to your nearest C-E office or to the General Offices in Windsor, Conn.

COMBUSTION ENGINEERING

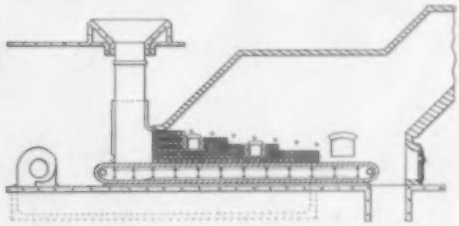
C-330

General offices: Windsor, Connecticut

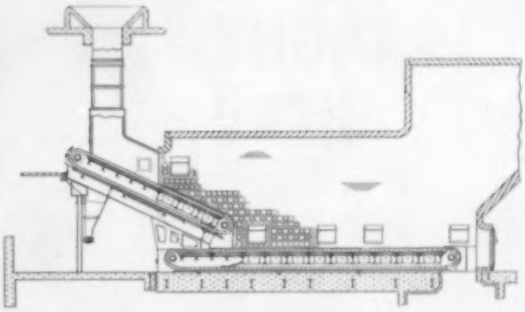
New York offices: 200 Madison Avenue, New York 16

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE

FLEXIBLE DESIGN ADAPTS TO NEEDS OF INDIVIDUAL COMMUNITY

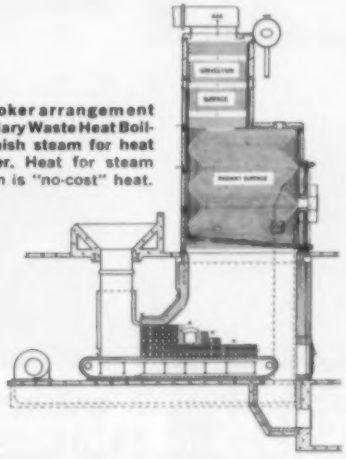


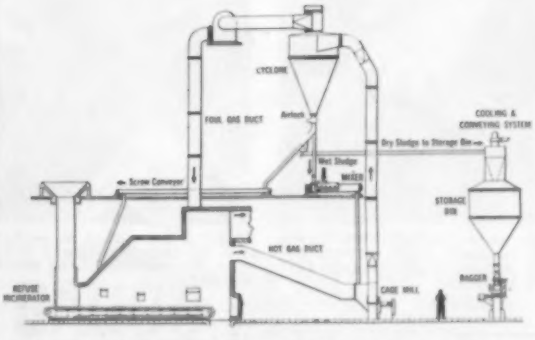
1. **Single stoker arrangement recommended for smaller communities.** Capacity ranges upward from 50 tons per 24-hour day.



2. **Tandem stoker arrangement recommended for larger communities.** Refuse is dried on the inclined grate prior to burning on the horizontal grate.

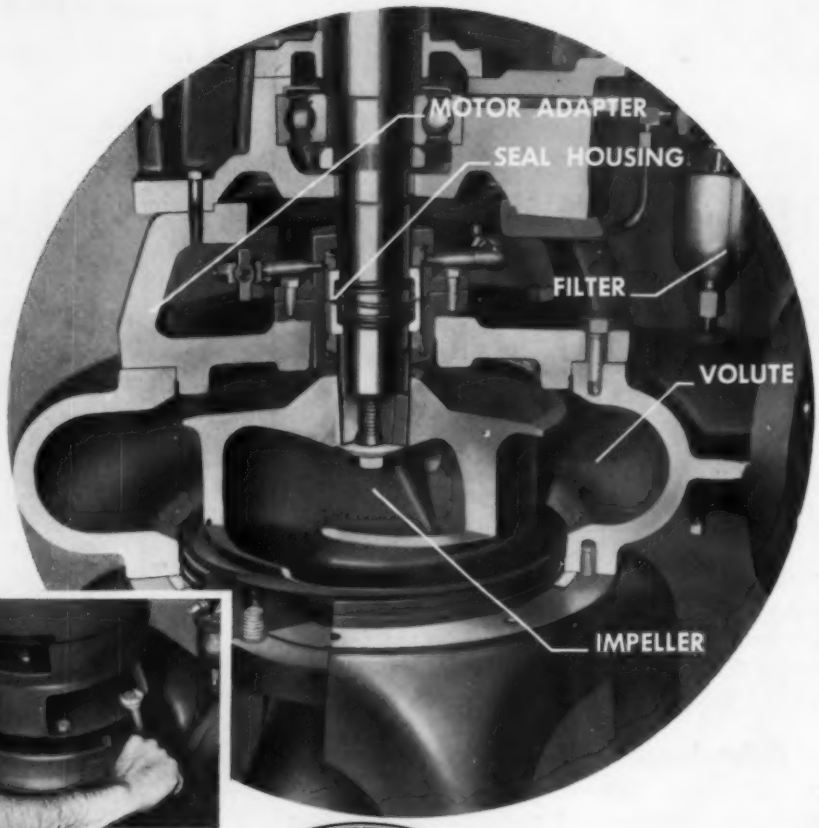
3. **Single stoker arrangement with auxiliary Waste Heat Boiler to furnish steam for heat and power.** Heat for steam generation is "no-cost" heat.





4. **Arrangement for disposal of both refuse and sewage sludge.** Features C-E Raymond Flash Dryer to dry sludge for burning in the furnace, or for use as a sterile soil conditioner.

THE DIFFERENCE IS RIGHT HERE



To replace the mechanical seal, the maintenance man throws the circuit breaker to "OFF" and isolates the pump by closing the gate valves. Disconnecting the seal filter lines takes **LESS THAN A MINUTE.**

To connect a hoist between the motor and the ceiling lifting rings, and remove the motor adaptor from the pump volute takes **LESS THAN 3 MINUTES.**

To raise the motor-impeller assembly, remove the impeller locking bolt and release the impeller from the tapered shaft takes **LESS THAN 3 MINUTES.**

To remove the motor adaptor, that contains the mechanical seal housing, from the motor takes **LESS THAN 2 MINUTES.**

To remove the mechanical seal housing from the adaptor means removing only three alternate screws and takes **LESS THAN A MINUTE.**

To get to the heart of the mechanical seal and replace the entire unit has taken the maintenance man **ABOUT 10 MINUTES.**

S&L

IT TAKES LESS THAN 30 MINUTES for an average maintenance man to replace the double mechanical seals on a Smith & Loveless "Non-Clog" Sewage Pump under normal conditions, even reading the instructions as he goes along. It doesn't happen very often (some of our seals have been in service over five years) but when it *is* necessary to replace the seal, it's nice to know that it takes him only about 10 minutes to remove the seal housing without special tools (as pictured, step by step) and about twice that long to replace the seal and put the pump back in full service.

A maintenance man's dream? Yes, because *this* pump was built with him in mind! It's the one pump designed to meet *all* the "must" requirements for sewage service . . . *Write to Department 40*

P.S. And . . . Don't throw away that old seal! Return it to the factory where it can be reconditioned, like new, for a fraction of the cost of a new one.

Smith & Loveless

ONE OF THE UNION TANK CAR COMPANIES

P. O. BOX 8884 / KANSAS CITY 15, MISSOURI / PLANT: LENEXA, KANSAS

(3819)

6111

GALION ROLL-O-MATIC TANDEMS save minutes on every pass

From initial pass to finish rolling, you compact more surface faster with Galion Roll-O-Matic Tandems. That's because Roll-O-Matic Drive *actually detects* changes in rolling conditions and automatically maintains selected speed uphill, down or on the level.

Roll-O-Matic really takes over the speed-control job. Enables your operator to concentrate on producing a level finish without marks or creases. Smooth transmission of power, free from sudden surges of power, saves minutes on every pass.

You can count on important savings from Roll-O-Matic Drive with all Galion Tandems, whether it's the versatile 8-12 ton model shown here, or one of the many other variable weights from 3 to 20 tons. All have power-to-spare engines, fingertip hydraulic steering and practical dual controls.

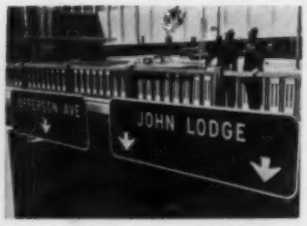
Put a Galion Tandem to work on your next job—see how it keeps compaction work smooth, efficient and often ahead of schedule. For complete information, contact your Galion distributor or write for Catalog on Tandem Rollers.

GALION
ROLLERS AND GRADERS

RENT A ROLLER
Ask your Galion distributor about our cost-cutting Rent-A-Roller Plan.

THE GALION IRON WORKS & MFG. COMPANY, Galion, Ohio, U.S.A.
General and Export Offices, Galion, O., U.S.A., Cable Address, GALIONIRON, Galion, O.

About Our Cover



Developments in Detroit and Wayne County over the past three or four decades have been so great as to present many challenges and problems in public works engineering. The marked increases in population in the area have resulted in a 1960 population in Detroit of 1,670,000 and in Wayne County of approximately 2,700,000, including the city of Detroit. To serve this population with transportation, housing, water, sewerage and drainage has required a high degree of skill, adequate governmental organization and cooperation between city and county. Two of the engineers responsible for meeting the engineering problems in this area are Glenn C. Richards, Commissioner of Public Works for Detroit and Joseph W. Gross, County Highway Engineer for Wayne County. On the cover they are pictured above the entrance to an expressway tunnel which passes beneath the largest Convention Hall in the country, a design which was worked out by close cooperation between highway engineers and the architect.

Glenn C. Richards is in charge of the public works activities in Detroit that include sewerage; streets; expressways; city automotive equipment; maintenance and operation of city buildings; refuse collection and disposal; street cleaning; snow and ice control; and city docks and piers. Over the past 20 years he has devoted much time to promoting, financing and building expressways for Detroit and the state.

He was graduated with a BS in CE from the University of Michigan in 1924 and has been with the City of Detroit for the past 21 years. He was appointed Deputy Commissioner of Public Works in 1941; Director of Civil Defense in 1941; Commissioner of Public Works in 1944 and Expressway Coordinator in the same year; and Highway Administrator in 1950. Extra duties and assignments include: Commissioner of the Wayne County Board of Public Works; a member of the County Board of Supervisors; and member of the Regional Plan Committee. He is past president of the Michigan Good Roads Federation; past chairman of the National Committee on Urban Transportation; and a member of the Executive Committee of the Highway Research Board. Long active in the American Public Works Association, he is currently a member of the APWA's Transportation Committee. In 1960 he was named as one of the Top Ten Public Works Men-of-the-Year.

He and Mrs. Richards (who is Michigan Director of the National Education Association) have two daughters. All the family are graduates of the University of Michigan. Hobbies are golf, winter sports, swimming and badminton.

Joseph W. Gross, Wayne County Highway Engineer, is general manager of all operations under jurisdiction of or under contractual assignment to the Board of Wayne County Road Commissioners. These include: Design, construction and maintenance of the 1900-mile county road system; the Detroit Metropolitan Wayne County Airport; the 4,000-acre County Park system; the Out-County sewage disposal system; the $50 million Out-County water supply system; and the design, acquisition of rights-of-way, construction and maintenance of highway trunk lines and freeways in the county. He has been with Wayne County for the past 32 years. He earned his BS in CE degree from the University of Pittsburgh in 1925 and a LLB degree from Detroit College of Law in 1940.

Mr. Gross is a member of ASCE, APWA, ARBA, and other professional societies. He is a registered professional engineer and land surveyor and a member of the State Bar of Michigan. His hobbies are art appreciation and collection; music; and some sports. □□□

Performance
Operator comfort
Wearability
Ease of maintenance
Reliability

ALLIS-CHALMERS EXPANDED MOTOR GRADER LI

...with BIG P-O-W-E-R extras for long-range on-the-job action

Pick the Allis-Chalmers grader that fits your job best. Compare the features that make any machine in this line so profitable to own. Then ask about the advantages that make them preferred among men who make their living behind a blade. You'll like what you see and hear.

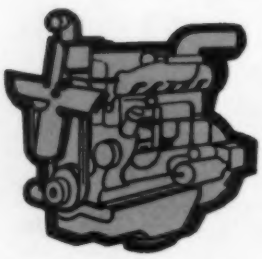
If you're in the medium-size grader class, you'll find all the job-taming, down-to-earth things you want in a motor grader are in the 145T—newest addition to the Allis-Chalmers line. Now for the first time in years, you can again get exclusive Allis-Chalmers advantages on a unit in the 105-hp range.

But the big news isn't just 145T. The entire line has taken a big step forward. It will pay you to get the complete story before you buy your next grader.

ALLIS-CHALMERS ENGINES KEEP PRODUCTION HIGH

Choose any grader . . . get an engine power-balanced to match its size. All feature dependable performance and rapid acceleration. High-torque characteristics give them excellent lugability to hang on to big loads.

127-HP (10000) engine 45

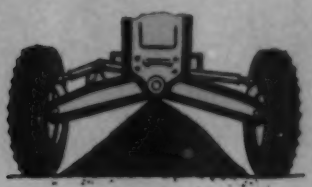


105-HP (7000) engine (turbocharged) 145T

80-HP 344 engine 145

LINE

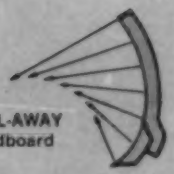
THESE BASIC ADVANTAGES MEAN BEST RESULTS...WITH BIG WINDROWS OR AT THE BLUE TOPS



Extra-high axle and throat clearance —let you use full blade capacity.

Toggle controls—provide precise, positive blade handling.

Flat, clean deck—excellent visibility keep operators comfortable and productive.

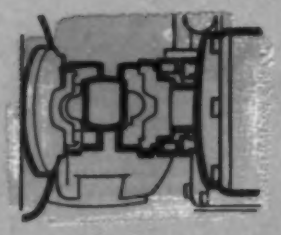


ROLL-AWAY moldboard

Ordinary moldboard

ROLL-AWAY moldboard—converts hp into extra output by rolling rather than pushing loads.

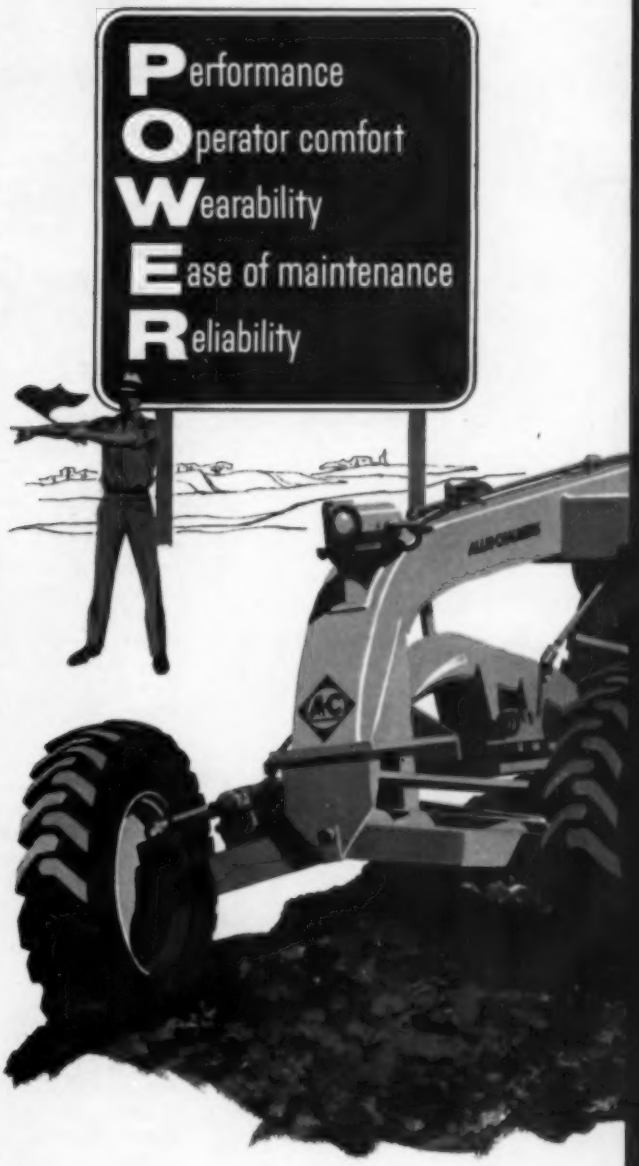
ROLL-AWAY is an Allis-Chalmers trademark



True unit construction—provides for fast, cost-cutting shop servicing.

Step up your MOTOR GRADER

Performance
Operator comfort
Wearability
Ease of maintenance
Reliability



WITH ALLIS-CHALMERS

Here's a project geared to the demanding standards of today's earth-moving men . . . bringing them the benefits of Allis-Chalmers' massive research and development in the form of significant product improvements.

ALLIS-CHALMERS MODEL D

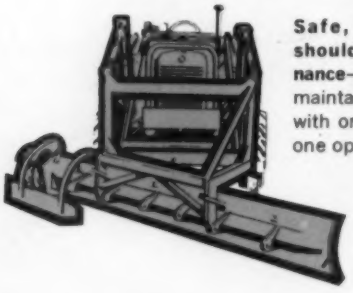
58-hp gasoline
58-hp diesel

Equipped with a ¼-yd loader, the D does top grading job, handles its own cleanup.

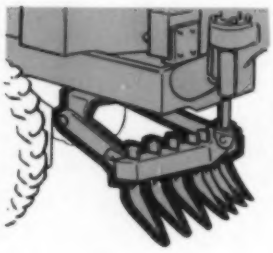
NOW! MORE VALUE ADDED TO THE BEST BUY IN MOTOR GRADERS

Pioneer in the low-cost grader field, the Model D takes on a new look and new value. A new square-section frame adds strength down the middle . . . tandem drive chains are stronger for long, tough service. The D is still out front as a handy grader for spot jobs on big contracts or as a solo machine for the smaller job. And a D's low price is still less than half the cost of a large grader.

ONLY THE D GIVES YOU SO MUCH ADDED USEFULNESS



Safe, one-pass shoulder maintenance—rebuild and maintain shoulders with one machine, one operator.



Full-scale scarifying—exclusive midship-mounting puts grader weight to effective use, keeps steering easy.

For new power, new features, new performance, new value through the entire line—see these graders in action before you decide on your next machine. Your dealer will arrange all the details.

LITHO IN USA

Your Allis-Chalmers dealer is in business to . . .

PROTECT YOUR EQUIPMENT INVESTMENT WITH COMPLETE SERVICE

When you invest in Allis-Chalmers equipment, you get top performance in *every respect.* Your Allis-Chalmers dealer is fully equipped to serve you completely, conveniently. Make him your single source for:

- **Complete Parts Service**—original-quality parts on hand to meet your requirements quickly.
- **Ready-to-go Exchange Assemblies**—completely reconditioned assemblies on call. Your trade-in assembly is rebuilt without overtime charges . . . your machine is back to work quickly. Your cost? Only parts and regular-time labor needed to recondition your old assembly.
- **Specialized Service—Shop or Field**—top-notch mechanics are factory-trained to service your needs efficiently in a fully equipped shop or on your job.
- **Tailored Financing**—terms suited exactly to the financial requirements of all your machinery needs.

From one convenient source, then, you get the complete service package—job application information, new and used equipment, parts, service and financing. Who could be more interested in backing you up than your own dealer? That's his *business!*

Your every transaction in sales, parts, service and financing is fully backed and .....

ALLIS-CHALMERS

POWER **FOR A GROWING WORLD**

Certified FOR YOUR PROTECTION
BY YOUR ALLIS-CHALMERS CONSTRUCTION MACHINERY DEALER

IN USA D&J-61

OWNER: Palm Springs Utilities, Palm Springs, Florida
ENGINEER: Brockway, Weber & Brockway
PROJECT: Village Sewage System
CONTRACTOR: Hillier Excavation & Construction Co.

Positive leakproof joints . . . coupled in seconds . . . specify U. S. Uniloc Flexible Couplings!

If you're planning a waste disposal system that will encounter difficult installation problems and severe "in service" corrosive conditions . . . specify United States Vitrified Clay Pipe with Uniloc Flexible Couplings.

U. S. Pipe with Uniloc is a completely integrated pipe unit that seats permanently in just seconds. Uniloc multiple seal ring provides a true compression, leakproof joint that resists the corrosive attack of raw sewage, petroleum products, high concentrates of most acids and alkalies and industrial wastes . . . and Uniloc "builds in" ample flex for pipe angularity, soil stress and over burdens.

United States Pipe with Uniloc Couplings provides a permanent solution to most any waste handling problem . . . and at *lower* cost. Drop us a note on your letterhead and get complete information.

8503

UNITED STATES CONCRETE PIPE CO.

A SUBSIDIARY OF PITTSBURGH COKE & CHEMICAL COMPANY

1501 East Ohio Building • Cleveland 14, Ohio • Telephone MAin 1-5240

Sales Offices: Baltimore • Pittsburgh • Philadelphia • Cincinnati • Ft. Lauderdale • Ocala • Kalamazoo

2 NEW FITCHBURG CHIPPER FEATURES

Give Your Engine Longer Life
Save Gas, Add Safety

1 **EXTRA PROTECTION** for your crews with this NEW SAFETY STOP SWITCH that stops all moving parts of the chipper within seconds. Switch is within easy reach at rear so operator can flip it without moving from feed position. An important new feature of the Fitchburg Chipper, *already considered safest* because it has no hard-to-control flywheel.

2 **GREATER ECONOMY** with this NEW SOLENOID SWITCH* which allows the operator to quickly idle the motor between actual brush feedings. With the motor idling, you save on gasoline and engine wear; and there's less noise, which pleases the public. Your operator can use the switch easily because it is at the rear and handy.

CHIPPING IS SMOOTHER and faster with a Fitchburg because of its exclusive *spring activated feed plate.* This patented feed plate "gives" *automatically* under pressure. You can chip even large limbs (up to rated capacity) without killing the engine. And your crews are safer because the feeding action is more positive, smoother, with less whipping of the brush.

CHIPPING IS MORE EFFICIENT with a Fitchburg. The exclusive feed plate allows wood to be chewed up in small bites. This takes less power, and the engine can be run at lower r.p.m.—which is more efficient, saves you gas and cuts engine wear.

TROUBLE-FREE Fitchburg Chippers stay out of your shop so you don't lose valuable man-hours. These rugged machines are the choice of tree surgeons, line clearance contractors and others—men who depend on Chippers day after day to make money. Blades are made from special alloy steel to hold a keen edge for a long time, even with hard use. Fitchburg Chippers are well-engineered, come in four sizes to meet your needs: the largest handle limbs as thick as seven inches with ease.

A FREE BOOK "Chip Dollars" should be in your hands if you deal with brush disposal. 20-pages. Write for free copy — Dept. PW-19.

*optional equipment

FITCHBURG ENGINEERING CORPORATION FITCHBURG, MASS.

Trench under the track?
...easy job with a John Deere!

Needle-threading precision is standard performance for John Deere Backhoes with two-lever control. Boom, bucket, and dipper-stick functions are always right in the operator's hands—an important feature which provides fast working speeds, smooth operation. Instant-response hydraulics assure deft, efficient control.

Two John Deere Backhoes, the center-mounted 50 and five-position 51, are available to meet the many varied needs of municipal street departments. When mounted full left or full right as required, the 51 makes it possible to trench flush along building foundations, walls, or fences. The mounting position of the rotary boom cylinder is easily changed in the field by one man, using only a wrench and the backhoe's hydraulic power.

John Deere Backhoe combinations are now offered with the 40 engine h.p. "1010" Crawler or Wheel Tractor, the 50 engine h.p. "2010" Wheel Tractor, and the "3010" Wheel with 64 engine h.p. (gasoline) or 69 engine h.p. (Diesel).

For full specifications and a demonstration, contact your John Deere dealer now through the yellow pages of your telephone directory. John Deere, 3300 River Drive, Moline, Illinois.

JOHN DEERE

LOADERS

BULLDOZERS

BACKHOES

AND

CONSTRUCTION

EQUIPMENT

WATER TREATMENT— INDUSTRIAL & OTHER

Since Eskel Nordell wrote his book "Water Treatment for Industrial and Other Uses" in 1951, there have been tremendous advances in many phases of the subject. In this second edition, which is revised and expanded, the author has covered all these new areas in a usable and practical manner. Probably the most complete book on the subject, it reads easily and gives precise information, spiced with notes of historical interest. Chapters include: Dissolved mineral matter; dissolved gases; turbidity, color, taste, etc.; industrial water conditioning; commercial and institutional water conditioning; municipal water conditioning; boiler feed waters; cooling; aeration; sedimentation and filtration; cation exchange processes; and cold and hot water softening.

The book will serve as an excellent reference and review for the experienced water works superintendent and engineer, yet it is so written as to be understandable and usable by personnel having minimum technical training.

The author is Director of Technical Information for the Permutit Co. and has long been active in water treatment work. His new book contains 608 pages and is well illustrated. The price is $12 from Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y.

MILWAUKEE WATER WORKS REPORT

The annual report for 1960 for the Milwaukee, Wisc., Water Works is attractive and well prepared, with much useful data on treatment, pumping, distribution and the management phases. Highest pumpage for any one day was 285.3 mg; the lowest 91.18 mg. Average consumption was 165 gpcd. A. Rynders is Superintendent.

HELIX IRRIGATION DISTRICT REPORT

Growth problems of water supply are well illustrated in the 1960 report of the Helix Irrigation District, La Mesa, Calif. In the ten years,

MUELLER®

ORISEAL® VALVES NOW RATED AT 175 P.S.I. AND 180° F.

The more positive seal provided by the Mueller Oriseal Valve has resulted in both the maximum water working pressure and test pressure being raised 40% . . . to 175 p.s.i. At the same time, maximum water temperature ratings have been boosted 20% to 180° F. Offering advantages found in no other curb stop, the Oriseal has a "Teflon"* coated, balanced plug that requires no lubrication or maintenance, yet turns freely even after many thousands of operating cycles.

New . . . Oriseal with Minneapolis Pattern!

Mueller Oriseal Curb Valves in the ¾" and 1" sizes available with Minneapolis threads and matching curb boxes.

*DuPont Company registered trademark

New Oriseal Curb Valve Specifications

- Full Round Way Opening
- Solid Tee Head with ¼" rod hole
- Quarter Turn with Check
- 175 p.s.i. Water Working Pressure
- 175 p.s.i. Test Pressure (Every Oriseal Valve is tested with 175 p.s.i. air pressure under water in both open and closed positions—a much more exacting test than hydrostatic testing)
- 180°F. Maximum Water Temperature
- Sizes: ¾", 1", 1¼", 1½", 2" (¾" and 1" also offered with Minneapolis Pattern)
- Inlet and/or Outlet available with Inside I.P. Thread, Mueller Copper Service Pipe Connection

Write for complete information and specifications.

MUELLER CO. since 1857 SERVING the Water and Gas Industries QUALITY 6234

MUELLER CO.
DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles
In Canada: Mueller, Limited, Sarnia, Ontario

1950 to 1960, services increased from 17,630 to 33,230 and plant and equipment valuation from $5.9 million to $22.0 million. An adequate source of future water supply remains a problem. Byron M. Miller is General Manager.

MUNICIPAL YEAR BOOK for 1961

This is the 28th annual edition of a widely useful book. As is natural in a census year, considerable attention is given to the effects of the 1960 census, especially to metropolitan problems. Reports from 50 regional planning agencies review trends and future problems. There are data on sewerage service charges and other sewerage financing from some 650 cities, covering both new and older built-up areas. Also some 700 cities report on off-street parking, with charge data. Other subjects include zoning, subdivision regulations, overtime pay, directories of city officials and model municipal ordinances. Orin F. Nolting and David S. Arnold are the editors. The Yearbook is published by the International City Managers' Assn., 1313 East 60th St., Chicago 37, Ill. It contains 594 pages and the price is $10 postpaid.

ENGINEERS IN INDUSTRY

This is a report of a study sponsored by NSPE to analyze the problems of the engineer in industry—his goals, his problems and what can be done to aid in his search for professional status and recognition. There are 148 pages. $4 for non-members of NSPE; $2 for members; from NSPE, 2029 K St., N. W., Washington 6, D. C.

UNIFORM TRAFFIC CONTROL DEVICES

This is the first complete revision since 1948 of the Manual on Uniform Traffic Control Devices for Streets and Highways. The revised standards reflect changes in driving conditions and technical advances in control devices and practices. Also included are such newer subjects as freeway signing, controls for construction and maintenance operations, civil defense and signalling for reversible unbalanced lane operation at peak hours. Many of the options and alternatives in the old manual have been eliminated, a single standard procedure now being generally recommended. The provisions of the new manual will be mandatory on Federal-air system projects. The revision was prepared by a National Joint Committee representing several organizations. There are 333 pages; many illustrations; $2 from Supt. of Documents, Government Printing Office, Washington 25, D. C.

GUIDE TO ZONING BOARDS OF ADJUSTMENT

To define and clarify the functions and powers of Zoning Boards of Adjustment, the New Jersey Department of Conservation and Economic Development, Salvatore Bontempo, Commissioner, has published a 22-page booklet. Designed especially to aid municipal, county and regional officials, special terms are defined and illustrated by means of examples. Advice on procedure is also included with emphasis on accurate and complete record keeping. The price is $2; order from the Department at 33 West State St., Trenton, N. J.

LOUISIANA WATER & SEWERAGE SHORT COURSE

This text contains the proceedings of the 23rd Annual Short Course for superintendents and operators of water and sewerage systems. There are 38 papers, covering the whole range of instruction in these areas and these add up to the usual standard of excellence. There are 283 pages; $2.50; Bulletin 65, Engineering Experiment Station, Louisiana State University, Baton Rouge 3, La.

PURDUE ROAD SCHOOL PROCEEDINGS

The Proceedings of the 46th Purdue Road School, held in April, 1960, are now available in printed form as 105 of the Engineering Extension Series. It contains 25 papers in its 269 pages. Free on request to The Engineering Bulletin, Purdue University, Lafayette, Ind.

• • •

Training Programs In Water

The Public Health Service will conduct a 2-week course in Plankton Identification and Control, Oct. 16-27; 1-week courses on Radioactive Pollutants in Water, Nov. 6-10 and on Radionuclides in Water, Nov. 13 to 17; and a 2-week course on Chemical Analyses for Water Quality, Dec. 4-15. All will be held in Cincinnati and full information is available from Chief, Training Program, Sanitary Engrg. Center, 4676 Columbia Parkway, Cincinnati 26, Ohio, or from any PHS regional office.

"UNANIMOUS agreement!" That's what the council said to Borough Secretary Charlie Schmidt after he "pitched" for Alcoa Signs at the Whitehall Borough Council meeting one night last winter.

"He should work for Alcoa!" remarked one member after hearing—and agreeing with—Charlie's argument.

"Aluminum signs will cost us a lot less," said another councilman. "Our tax dollars will certainly go a lot further, just from the savings in maintenance costs!"

"Our vandalism problem has been greatly reduced," asserted Borough Captain of Police, John Wilson. "These Alcoa Signs can really take it! The safety factor of the luminescent, reflective surface shouldn't be overlooked, either."

"Competitively priced with other sign bids and other materials," concluded Charles A. Schmidt. "I am confident we can substantially reduce sign maintenance costs by starting an aluminum

"You should work for Alcoa and sell these signs," chides Whitehall Burgess A. J. Munn (left), as Borough Secretary Charles Schmidt demonstrates Alcoa Sign sturdiness to Police Captain John Wilson.

Charlie Schmidt delivers a sales pitch Alcoa didn't pay for!

street and stop sign replacement program."

"Unanimous agreement!" intoned the council.

P.S.—This is a true story. Although the quotations may not be verbatim, the facts and the meanings are true. In less than two years, Whitehall Borough—a suburban community of Pittsburgh, Pa.—will complete its sign replacement program. Every stop sign and every street sign in the borough that has become defaced, rusted, worn out or illegible will be replaced with a sign made of Alcoa® Aluminum. We couldn't make the sales presentation ourselves, but we think Charlie Schmidt did a fine job in our stead.

Call your nearest Alcoa sales office and learn how *your* community can stretch tax dollars with Alcoa Aluminum Street and Stop Signs and at the same time qualify for the big FREE Alcoa "Welcome to Your Town" sign. Or write: Aluminum Company of America, 897-J Alcoa Building, Pittsburgh 19, Pa.

ALCOA ALUMINUM

HIGHWAY PRODUCTS

Pioneer in city communications—and one of the first men in the country to use Leece-Neville alternators, Ben Demby is superintendent of Miami's Division of Communications. Ben is pictured above checking out radio and telephone equipment, just tranferred to his new Plymouth. This equipment includes 4 dual frequency radios, one a Bell Mobile (3 systems are transistorized). Photo center top shows installation in trunk of car. Bottom center photo—Ben checking factory-installed Leece-Neville alternator with L-N factory representative, Jack Young. According to Ben Demby—"Leece-Neville alternators assure better radio life and performance because they provide ample current and constant voltage. By eliminating battery problems, you eliminate radio problems."

Leece-Neville Alternators keep communications loud and clear for the City of Miami

At the same time, L-N alternators eliminate dead batteries, reduce service calls, and cut maintenance costs

On call 24 hours a day for 6 years, this Miami Fire Department Rescue Unit is equipped with 3 radio units, sirens and lights. The Leece-Neville alternator on this truck was installed at the factory before delivery, and has required only one service call in 6 years.

"Battery life doubled... service calls reduced drastically... better radio transmission . . . practically no alternator maintenance"—this is the record for Leece-Neville alternators on City of Miami police cars, according to Roland Joynes, superintendent of the Miami Motor Pool.

The City of Miami was one of the first to use Leece-Neville alternators in municipal service. That was in 1945. Today this popular vacation city has more than 120 Leece-Neville alternators in service, including new corrosion-resistant L-N alternators specified and factory-installed on 44 new Plymouths for police, fire and communications duty. City officials report that Leece-Neville alternators assure peak radio performance, eliminate dead batteries and reduce maintenance costs. For details on how Leece-Neville alternators can help cut costs in your operations, just mail the coupon at the right.

Specify Leece-Neville alternator systems as factory-installed special equipment on new vehicles.

QUALITY ELECTRICAL EQUIPMENT
Leece-Neville
SINCE 1909

The Leece-Neville Co.
Dept. PW-9
1374 East 51st Street
Cleveland 3, Ohio

Please send me complete information about alternator systems and other products for my type of service.

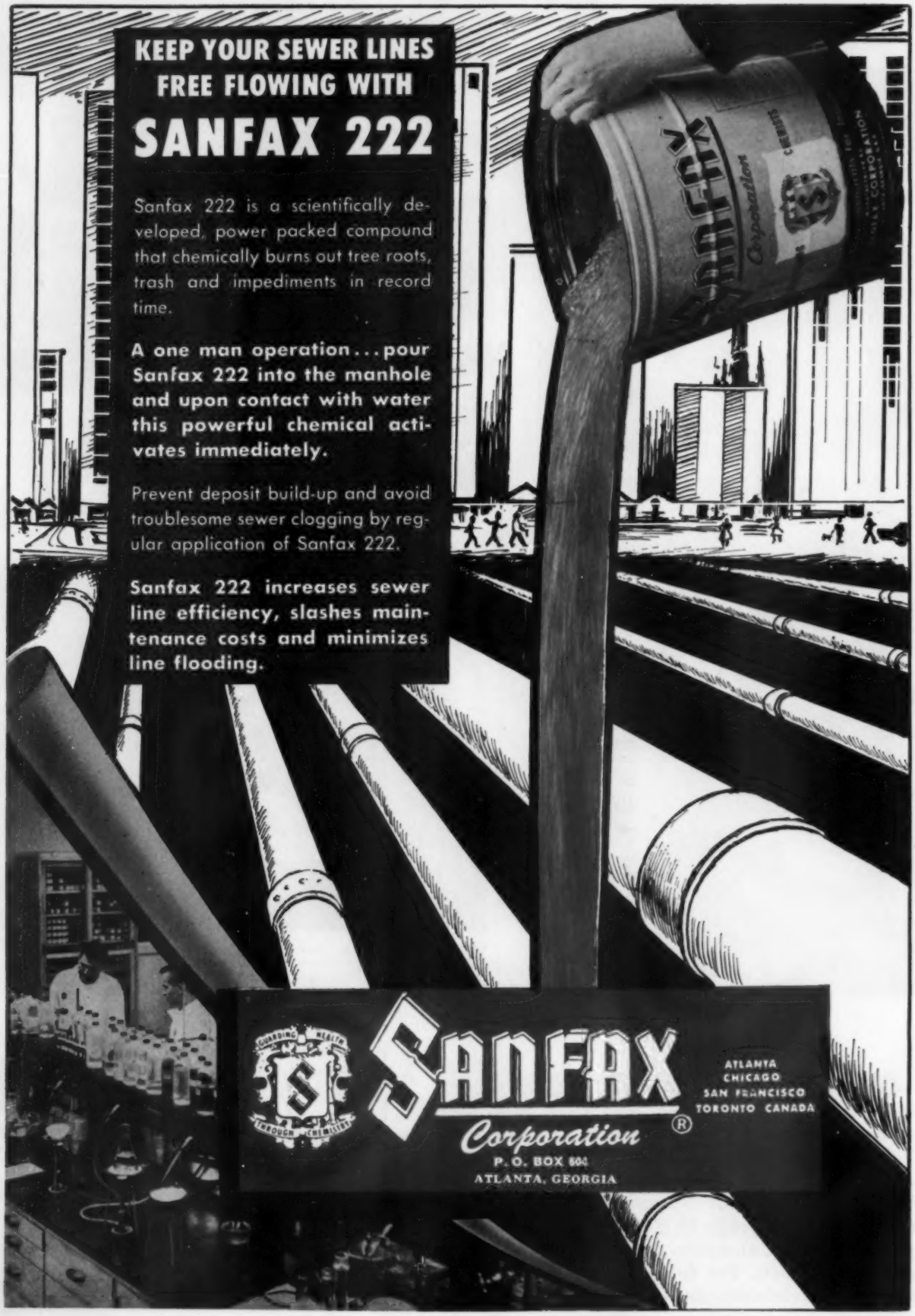
Name _____ *Title* _____

Firm or Dept. _____

Address _____

City _____ *Zone* ____ *State* ____

Type of Service _____


KEEP YOUR SEWER LINES FREE FLOWING WITH
SANFAX 222
Sanfax 222 is a scientifically developed, power packed compound that chemically burns out tree roots, trash and impediments in record time.
A one man operation... pour Sanfax 222 into the manhole and upon contact with water this powerful chemical activates immediately.
Prevent deposit build-up and avoid troublesome sewer clogging by regular application of Sanfax 222.
Sanfax 222 increases sewer line efficiency, slashes maintenance costs and minimizes line flooding.
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ATLANTA
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SAN FRANCISCO
TORONTO CANADA

Here's how TRIDENT Model 60 CUTS YOUR COSTS

Everything new in metering is in Trident Model 60. This is the meter that protects your present and future investment. This is the meter that gives you all the advantages of modern, sealed construction, plus two most important money-saving features. Study these features. You'll see for yourself why Trident Model 60 offers impressive savings in your overall costs. And your system's investment (for which you are responsible) is protected . . . now and in the future. May we show it to you? Phone your Neptune representative, or write today.

1. It can be repaired, reset to zero and recalibrated in your own shop. No need to scrap half a meter just because a minor part is damaged.

2. Older Trident meters can be modernized. Both Model 60's sealed register and sealed gear train are interchangeable with present Trident parts. There's no obsolescence.

Non-fogging sealed register, can be repaired, re-sealed, re-dehumidified. Replaceable crystal. Powerful shielded magnetic drive. Has sweep test hand. Wheels can be reset to zero . . . a boon to utilities who turn repaired meters back to zero for good public relations.

Change gears . . . exclusive among hermetically sealed meters . . . permit adjustment of registration. No need to lose income just because of a little wear or mineral deposits. No need to scrap expensive major components for lack of change gears.

Totally sealed gear train. Water never touches gears. No corrosion. No water or oil leaks. Sealed and lubricated for life. Powerful shielded magnetic drive.

Quiet Trident flat-disc measuring element. The finest, most wear-resistant and trouble-free principle. Remarkably sensitive to "leak type" low flows. Stays sensitive longer because it's precision machined to minimize effects of wear or deposits.

neptune
METER COMPANY
LIQUID METER DIVISION
47-25 34th Street, Long Island City 1, N.Y.

OFFICES IN PRINCIPAL CITIES
In Canada: Neptune Meters Ltd.
1430 Lakeshore Rd., Toronto 14, Ont.

How would you like

$2000 PROFIT

Sounds fantastic . . . but it's true! If you use equipment to *pull*, *push*, *dig*, *lift* or *load*, you can save up to $2000, in just the time it takes to sign your name on an order for a new Case industrial tractor.

That means you make a handsome profit *before the equipment moves an inch.*

Certainly price alone isn't reason enough for you to buy *any* working tool for your business. But here, in Case machines, you also know you're getting premium quality, a fine record of performance, that insures you an extra return on your investment every day it works for you.

You'd be wise to go into details with your Case dealer *now.*

Here's the Case deal in a nutshell: a better price to start with . . . quality beyond question . . . performance that speeds up your production. All good reasons for you to check into the outstanding buying opportunity you have right now.

It's "PROFIT PICKIN' TIME" NOW

to pick up IN 7 SECONDS?

SAVINGS UP TO

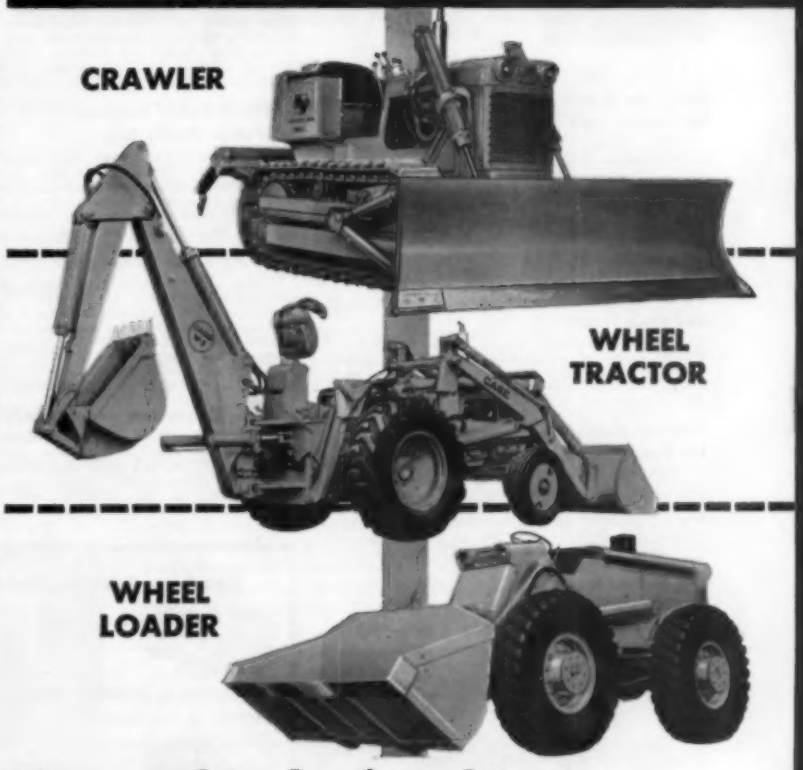
It's a fact that these savings are *especially* impressive when you consider the unusual advanced features that help give Case equipment its outstanding superiority. Here are a few:

- **Case crawlers with exclusive Terramatic® Transmission speed up the pace of production, help insure a better margin of profit on close-bid jobs. And better performance holds for every job after that for years to come.**
- **Operator comfort, extra safety factors and the utter simplicity of control provide additional bonus benefits. Matchless work visibility too, adds to operator productivity.**
- **You can get proof before you invest a cent. Just ask for a Case demonstration test. See any piece of Case industrial equipment do a better job faster, right before your eyes.**

ASK FOR A DEMONSTRATION NOW!

Your Case dealer needs only a call from you, an idea of the equipment you need. He'll set up a demonstration to prove every point we make. And then he'll quote you a deal no cost-conscious businessman could resist!

3 BASIC TYPES AVAILABLE...



Plus a multitude of combinations

at all CASE® INDUSTRIAL DEALERS

EQUIPMENT AND MATERIALS

For Your Public Works Program

NEW LISTINGS

Surge Arrestor

212. New 16-page Bulletin describes Cushioned Surge Arrestor Valve that anticipates the surge as well as opens immediately on abnormal pressure developing. Complete technical details and drawings included. For your free copy write for Bulletin W-16 to Golden-Anderson Valve Specialty Co., 1244 Ridge Ave., Pittsburgh 33, Pa., or use reply card.

Laboratory Control —A New Concept

215. 4-page 2-color bulletin announces and illustrates how fingertip control can be had over water treatment plant throughput. Suggests ideas for plant arrangements and structural modification to reduce structural costs through centralization of controls. Write for Bulletin Ref. No. 2.1.20-1 to B-I-F Industries, Box 276, Providence, Rhode Island.

Power Units and Electric Sets for Asphalt and Crushing Plants

218. New 8-page catalog complete with pictures, along with cutaway view of Allis-Chalmers "Thousand Series" diesels, to show important components of the engine and its combustion chamber. Tables of horse-power, etc., included. For your copy write for BU-768 to Engine-Material Handling Div., Allis-Chalmers Mfg. Co., Milwaukee, Wisc., or check card-number.

Large-Volume Incinerators and their Financing

219. Described in 4-page brochure with full details including suggested methods for local financing that will prove interesting. Get your copy from Module Incinerators Inc., 20 S. 15th St., Philadelphia 2, Pa., or use our reply card.

Asphalt-Plastic Liners for Ponds and Reservoirs

223. To effect complete containment and/or control of water and sewage, in lining reservoirs, sewage lagoons and sludge ponds. Three sheets of facts on this product available by writing for Bulletin No. 905 to W. R. Meadows, Inc., 2-18 Kimball, Elgin, Ill., or use our card.

Speed and Simplify Refuse and Garbage Collections

232. How to help your citizens help you do this is theme of four page illustrated folder that tells the whole attractive story. Write West Virginia Pulp & Paper Co., Multiwall Bag Div., 230 Park Ave., New York 17, N. Y., or check our card-number.

Three Types of Transmitters for Proportioning and Metering Systems

243. 8-page well illustrated brochure describes them. Include air signal, hydraulic differential, and float actuated types. Write for Bulletin 400 to Infilco, Inc., Tucson, Arizona, or circle number on our card.

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field of cities, counties or states.

How to Make Pipe Cutting Easier

233. Start by getting free folder describing equipment that does this, with operating instructions and full information. Write for catalog to Wheeler Mfg. Corp., Box 688, Ashtabula, Ohio, or use our reply card.

Quick Response Photoelectric Control

245. . . . for street lighting or any application where extended time delay is not desired. Comprehensive well illustrated 6-page brochure shows entire unit and its components, also dimensions, electrical characteristics and operating information. Write for Bulletin GEA-7230, to General Electric Co., Schenectady 5, N. Y., or check card-number.

3-Wheel Utility Vehicles for Public Works Jobs

255. Beautiful 8-page color-illustrated brochure outlines public works uses of Cushman Trucksters in meter reading, parking meter control, and personnel transportation of all kinds. Write for your copy today to Cushman Motors, Lincoln, Neb., or use our card.

Mercury Vapor Lamps

264. New booklet gives facts about their life and maintenance, construction and a chart on lumen output; also helpful lists of the various types, plus diagram showing construction details of new type Lifeguard mercury lamps. For your copy address Westinghouse Electric Corp., Lamp Div., Bloomfield, N. J., or check number on the card.

Motors, Generators and Controls

266. 12-page illustrated brochure concentrates on slow speed synchronous motors, 20 to 10,000 hp. Gives full data, specifications, application and cities typical installations. Write for Bulletin 502 to The Ideal Electric Mfg. Co., Mansfield, Ohio, or use our card.

Readers Service Index

New Low-Head-Loss Flow Tube

277. New 4-page catalog describes "Lo-Loss" Flow Tube, with technical data, performance comparison curves, and cut-away drawings of this new product. Write for Catalog No. 405 to Penn Meter Co., 4110 Haverford Ave., Philadelphia 4, Pa., or ring the number on our card.

Scientific and Test Instruments

279. Newly-revised condensed 48-page catalog with 100 illustrations portrays Honeywell instruments and systems for measurements. Check your instrumentation needs against it. Includes prices. Write for Catalog G-10b to Minneapolis-Honeywell Regulator Co., Station M389, Wayne and Windrim Aves., Philadelphia 44, Pa., or use our card.

Salt and Brackish Waters

283. Progress in Water Conversion is brought up-to-date for you in this 8-page illustrated brochure as applied to new thin-film water distillation process. For your copy of Bulletin GED-4135 write General Electric Co., Section 135, Lakeside Avenue, Burlington, Vermont, or check our card-number.

New Sealing Compound for Interior or Exterior Use

290. Catalog sheet describes and illustrates how POR-COLD sealing compound seals cracks and expansion joints from damaging elements. Complete details on Catalog Sheet No. R6640 to be had from the Monroe Co., Inc., 10717 Quebec Ave., Cleveland 6, Ohio, or by using our card-number.

Magnetic Drives for Pumps

314. In ratings from 50 through 2500 hp. Brochure describes and clearly illustrates the basic components of the magnetic drive, theory of operation, controls and design features. Write for Bulletin 3650 to The Louis Allis Co., 427 E. Stewart, Milwaukee 1, Wisc., or circle our card-number.

New Tractor Shovel Specification Bulletin

315. Just released, discusses salient features and gives detailed specifications of Model 254 Trojan shovel. Get your copy from The Yale and Towne Mfg. Co., Trojan Div., Batavia, N. Y., or use our reply card.

"Priceless Water"

316. This 4-page outline of how to promote adequate water facilities for your community is part of the Johns-Manville campaign to help water-needing communities to help themselves. Start by writing for new folder to Johns-Manville, Box 14, New York 16, N. Y., or use our card.

For Better Concrete Repairs

322. Folder describes the combination of adhesiveness and elasticity provided by "Albitol," an additive for mortar and concrete. Full data and directions for use available from American Vamag Co., Inc., 1615 51st St., North Bergen, N. J. Use the reply card.

Keep Your Sewers Flowing Freely

323. Get descriptive literature on a one-man operation with a compound that burns out roots, compacted trash and other sewer headaches. Write for data on Sanfax 222 to Sanfax Corp., Box 604, Atlanta, Ga., or use our reply card.

With a ⅜-yd. dragline bucket, BANTAM T-350 cleans out ditches alongside streets in Minden, La. High-speed production (up to 115 yds. per hr.) makes quick work of the job, lets Minden move its BANTAM on to other chores with savings in time and money.

City superintendent says:

"BANTAM is the best machine available for city work"

"We do anything we nave to do with our BANTAM," reports Superintendent R. K. Whitlock of the Minden, Louisiana, Street and Water Dept.

Minden uses its BANTAM on all kinds of jobs—cleaning out drainage ditches after heavy rains, loading gravel and sand for street maintenance, etc. "BANTAM is mobile and fast—and much more productive," says Mr. Whitlock. "I'd recommend BANTAM to any city that wants efficient, low-cost equipment. It's the best machine available for city work."

BANTAM IS A REAL "BUDGET-SAVER"

BANTAM T-350 is the most practical tool for handling jobs all over town: sewer and water line extensions and repairs, drainage ditches, culvert work, street and alley repairs, sanitary landfill projects. It's tops for all excavating work, materials-handling or speeding municipal building projects. As Superintendent Whitlock puts it, "BANTAM is as handy as a pocket on a shirt!"

Practical-sized BANTAM travels and works easily even in congested areas. BANTAM's big-rig features, 11-ton capacity and exclusive engineering advantages assure high speed, dependability and low operating cost.

11-ATTACHMENT VERSATILITY

With its 11 quick-change attachments, BANTAM is ready to work anywhere. And more than 25 optional features enable you to buy your BANTAM exactly as you want, to fit your specific job needs.

Let us prove to you why BANTAM is the most useful all-around rig you can own—the best investment for cities, towns and counties.

BANTAM COMPACT 250—New all-purpose, low-price crane-excavator! If you have a low budget yet want a big performing rig, the new Bantam Compact 250 is your perfect answer. It gives you Bantam's famed wide work range to do hundreds of jobs—trenching, loading, handling, cleanout, erecting, etc. You travel easier with Bantam's high-mobility. Lifts five tons, digs down to 12'11" with backhoe, (cable or hydraulic bucket control available). Ultra simplicity; cable-controlled digging-lifting operations—smooth, hydraulic 370° swing. Available on Bantam-built 4 x 4 carrier or mount on your own truck. Ask for details.

PW-284

SCHIELD Bantam Co.

301 Park Street, Waverly, Iowa

World's largest producer of truck crane-excavators

To order these helpful booklets check the reply card opposite page 38.

NEW LISTINGS (Cont.)

Valves to Operate?

325. Then get the data on how Pelton can do the work for you and do it better. For detailed information on spherical valves, write, Pelton Div., Baldwin-Lima-Hamilton Corp., 2929 19th St., San Francisco 10, Calif., or check our card.

Underdrain Blocks For Trickling Filter Beds

327. "Natco Tri-Filter" blocks are one piece salt glazed units, produced for both standard and high rate trickling filter systems. Shape details and sizes furnished in Bulletins TF-5 and TF-8, available from Natco Corp., 327 Fifth Ave., Pittsburgh 22, Pa. Check the reply card.

Put a "Magic Eye" In Your Sewers

330. To tell you by closed-circuit television where breaks, leaks, infiltration may be. The Inspectoline Television System enables you to see just where trouble is or may start . . . in lines as small as 6-inch. For full data address Inspectoline Inc., 9501 Euclid Ave., Cleveland 6, Ohio, or check our card-number.

Dotmar Pavers for Integral Gutters, Curbs and Sidewalks

335. Dotmar self-propelled curb and gutter paver is described in literature from Dotmar Industries Inc., 533 Hanselman Bldg., Kalamazoo, Mich. Check the reply card for full specifications.

An Asphalt Patcher Paver

339. On 30-days approval, free! Get the intriguing details by writing for "Hot Witch" literature to Charles Machine Works, Inc., 683 Birch St., Perry Okla., or use our reply card.

Refibering Sweeper Brooms Made Easier

342. Made cheaper, too, according to literature with full details. Write for yours to Ben-Ko-Matic, Inc., 8028 N Jersey St., Portland 3, Oregon, or circle number on our card.

How TV can Pinpoint Sewer and Water Main Problems

341. New method of closed-circuit TV inspection of your sewers offers great savings of money, time and labor. Also new PLANALYZED Contract Cleaning will repay inquiry about it. Address American Pipe Cleaning Co., 2231 Edgewood Ave., Minneapolis 16, Minn., or mark our reply card.

New All-Hydraulic Refuse Packer Body

344. If you cannot see it at the A.P.W.A. this month write for descriptive literature on it to M-B Corporation, New Holstein, Wis., or check our reply card.

The Traffic Adjusted Traffic System

345. Eight page Bulletin describes the "inside story" of Minneapolis Memorial Highway installation. Tells how proper relationship of supervisory equipment brings about efficient control of high volume grid areas and heavily travelled arteries. Ask for Bulletin E50, Eagle Signal Company, Moline, Illinois, or use reply card.

Use The Reply Card

Stumped by Stumps?

346. The Pow-R-Stump Cutter is operated by one man, handles stumps any width and up to 33 inches in height. Will not damage curbs, driveways, or sidewalks. A new Model 6 available—can go through a 3 foot opening—ideal for hard-to-get-in places. Five models to choose from. For literature, check the reply card or write Vermeer Manufacturing Company, Pella, Iowa.

Modern Incinerator Equipment

347. Incinerator equipment and appurtenances such as charging ash gates, water-sealed ash hoppers and ash scraper conveyors, skip hoists, refuse conveyors and equipment designed to minimize odors and lower labor costs are products of Beaumont-Birch Co., 1505 Race St., Philadelphia 2, Pa. Write for literature direct, or use our reply card.

BUSINESS ADMINISTRATION

If You are Considering a trustee for a Bond Issue Check with Chase Manhattan

236. For details on how a bank serves as trustee for bond issues for any municipal or governmental unit, write The Chase Manhattan Bank, 1 Chase Manhattan Plaza, New York 15, N. Y.

Monthly Time and Cost Record Book

249. To assist owners in determining the cost of owning and operating equipment Caterpillar Tractor Co., News Service, Peoria, Ill., has prepared a 24-page monthly time and cost record book. Twelve sets of pages are included on which to record day by day machine expenses for an entire year. Check the reply card for your copy.

Complete Bulletin On Municipal Supplies

473. Everything from leak locators to street signs is listed in the big 100 page bulletin "Municipal Supplies" published by Darley. Hundreds of different items for all city departments are included. Get your copy of Bulletin No. 163 from W. S. Darley & Co., 2814 Washington Blvd., Chicago 12, Ill.

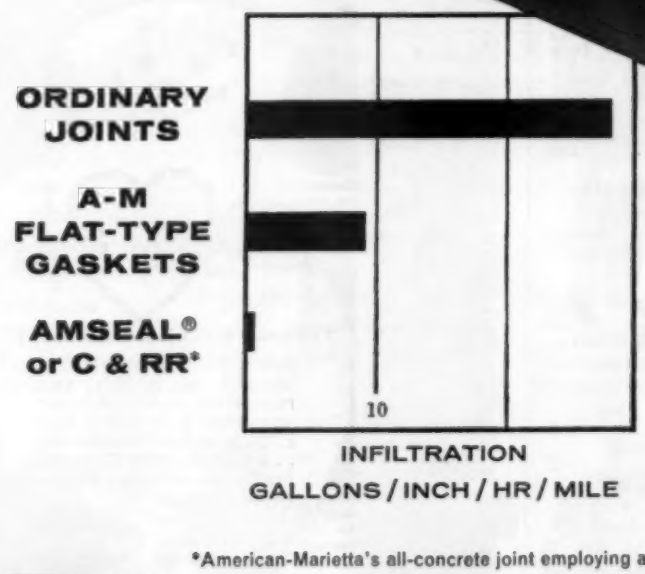
RECREATION

How to Equip Your Parks and Playgrounds

414. A handsome 60-page illustrated catalog showing a full line of extra heavy duty playground, park picnic and dressing room equipment, plus many related items, is now available from American Playground Device Co., Anderson, Ind. Complete specifications, construction features, prices and details of labor and materials needed for installation are included. Check the reply card.

PUT THE SQUEEZE ON INFILTRATION

WITH
AMERICAN-MARIETTA
Rubber Gasketed Pipe



American-Marietta flat-type gaskets and longer length pipe reduce leakage and provide savings through faster installation with fewer joints.

For positive control of infiltration specify AMSEAL (Rubber and Steel Joints) or C & RR (Concrete & Round Rubber Joints).

*American-Marietta's all-concrete joint employing a contained O-ring rubber gasket.

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CONCRETE PRODUCTS DIVISION
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AMERICAN-MARIETTA BUILDING
101 EAST ONTARIO STREET, CHICAGO 11, ILLINOIS, PHONE: WHITEHALL 4-5600

To order these helpful booklets check the reply card opposite page 38.

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute c/o Editor, Public Works, 208 So. Broad St., Ridgewood, N. J. Check the reply card.

How to Make Better Sewer Pipe Joints

37. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston Co., Dept. P.W., Adams, Mass. Check the reply card.

Theory of Controlled Digestion With Floating Cover Tanks

88. In an excellent 40-page booklet, an authoritative discussion of digestion theory and practices, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13, Ill. Complete data are given on the use of floating covers, together with details on tank construction, piping and control chambers.

Catalog on the Flynn and Emrich Incinerator Stokers

100. This catalog describes the Flynn and Emrich Incinerator stokers as to design, feeding capacities and loadings. Plenty of drawings of the stokers and photographs of incinerator plants under construction and in operation are included. Also, there is a good section on the incinerator history. Check reply card for catalog No. 1702 from Flynn and Emrich Co., Holiday and Saratoga Sts., Baltimore 2, Md.

Catalog on Synchronous Motors and Controls

64. A 27-page Catalog B-7292 on synchronous motors and controls is well illustrated and contains motor selector charts, application data, and formulas for calculating power factor. For a copy write Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa., or check the reply card.

Sewer Pipe Joint Sealing Compounds

104. Hot poured or cold applied, fully described in workmanlike file that gives specifications and prices. For your useful copy address Allied Materials Corporation, P. O. Box 7278 39th Street Station, Oklahoma City, Oklahoma, or use our handy reply card.

Packaged Pump Stations

126. Technical details on complete stations, graphically described and well illustrated to give you a quick grasp of their essential features. Write for Bulletin TQ-61 to Tex-Vit Mfg. Co., Box 117, Mineral Wells, Texas, or check our card-number.

Protective Lining for Concrete Pipe and Structures

131. T-Lock Amer-Plate is a tough, long-lasting acid-resistant vinyl sheet lining for concrete pipe and structures which are exposed to corrosive materials. T-shaped ribs pressed in the sheet are embedded in the concrete as it is poured to lock the lining permanently in place. Get full details from Amercoat Corp., South Gate, Calif.

Elliptical Concrete Pipe for Sewers and Culverts

143. A 4-page bulletin is available from United States Concrete Pipe Co., 1500 Union Commerce Bldg., Cleveland 14, Ohio, on the use of elliptical pipe to obtain round pipe flow equivalents in certain areas. Check the reply card for diagrams, data charts and tables that fully describe elliptical pipe sizes and compute discharge flow rates for the full range of pipe sizes.

How to Save $264 per Mile

216. . . . in sewer cleaning is the gist of a new 8-page brochure that discusses just how such savings can be accomplished. It costs nothing to find out and it may be your best investment of the day. Write for it to Flexible, Inc., 415 South Zangs Blvd., Dallas 8, Texas, or circle the card -number herewith.

Sewage Pumps That Minimize Clogging

220. This is the theme of a new 4-page folder that discusses both clogging and Gorman-Rupp sewage pumps; it is guaranteed to throw clear light on this old problem and to tell what pumps can reduce its frequency. For your free copy write The Gorman-Rupp Co., Mansfield, Ohio, or circle the number on our card.

Automatic Controls For Unattended Engines

278. To start and stop engines that are unattended. The multiple element itself gives six speeds and contacts. By adding a simple attachment 18 speeds are attained. Water, sewage and power plant heads will want Catalog 6 from Synchro-Start Products Inc., 8151 N. Ridgeway Ave., Skokie, Ill., or circle the card-number.

Bulletin on Waste Treatment Equipment

289. Equipment covered in Bulletin No. 315-11 includes bar screens, grinders, collectors, skimmers, separators and flocculation equipment. Check the reply card or write Chain Belt Co., Milwaukee 1, Wisc., for this data.

Do You Know the Value of the V-Notch?

295. A new booklet tells what you want to know about how chlorine feeding can be made as regular and precise as the sunrise. Ask for "The V-Notch Story" direct of Wallace & Tiernah Inc., 25 Main St., Belleville 9, N. J., or check the card-number.

clears up an age-old problem

Neither fogging nor clouding can ever prevent the easy reading of the new Badger magnetic drive meter. Easy-Read's register is hermetically sealed against dirt, dust, water and vapor.

Easy-Read has the biggest, most readable face yet to appear on the market. Its permanent digits stand a full ¼" tall. A special heavy tempered glass lens protects Easy-Read's face and preserves the seal. The tempered glass is highly resistant to breakage and scratching.

Badger has added still another unique design feature: the Easy-Read register is removable, even while the meter stays in the line.

Ask your Badger representative for full details and an Easy-Read demonstration.

The new Easy-Read can be ordered in split-case (⅝" thru 2") or frostproof models (⅝" thru 1" x 1¼")

Badger Meter Mfg. Company

4545 West Brown Deer Road • Milwaukee 23, Wisconsin

To order these helpful booklets check the reply card opposite page 38.

Learn About Positive and Easy Valve Operation

304. "LimiTorque" Valve Operators provide push-button control that enables one man to open and close any type of valve quickly and dependably, provide full protection from damage during closing cycle due to torque limiting mechanism. LimiTorque is available for operation by any power source and is readily adaptable to all types of remote control. Catalog L-550 completely describes and illustrates operation and installation. Philadelphia Gear Corp., King of Prussia, Penn.

When It Comes to Pumps

311. You will profit by having this 4-page condensed bulletin which illustrates and describes the Aurora Centrifugal and Apco Turbine Type Pumps with capacity ranges from 1 to 9000 GPM, and heads to 600 ft. Just write for your copy to Aurora Pump Div., The New York Air Brake Co., 630 Loucks St., Aurora, Ill., or circle number on card herewith.

Use The Reply Card

Trenches for Water and Sewer Line Construction

384. Three Cleveland J trenchers incorporating major advances in trencher design and operating advantages are described in Bulletin L-104 available from The Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio. Check the reply card for digging capacities, specifications and dimensions.

Packaged Sewage Treatment For Very Small Installations

477. Domestic sewage treatment for small developments, restaurants, schools, motels and other installations having flows up to 15,000 gpd can be handled in the single-tank CompleTreator. Compact, easily installed and simple to operate. Complete data in Bulletin 7315 of Dorr-Oliver, Inc., 77 Havemeyer Lane, Stamford, Conn. Use the inquiry card.

Manual on Structural Shapes

479. This 80-page catalog has a wealth of information, engineering data, and tables for engineers, architects and designers of steel buildings and other steel structures. Check the reply card or write Bethlehem Steel Co., Bethlehem, Pa., for your copy.

Wedge-Lock "O" Ring Joints for Vitrified Clay Pipe

482. Joints for large diameter pipe, using the Wedge-Lock principle of factory made joints plus a rubber "O" ring for compression sealing, described in 4-page folder of Evans Pipe Co., Uhrichsville, Ohio. Check reply card for your copy.

Descriptive and Performance Data on Sump and Sewage Pumps

483. Performance tables, selection charts, architect's and engineer's specifications and descriptive bulletins on Pacific sump and sewage pumps are available from Pacific Pumping Co., 9201 San Leandro St., Oakland 3, Calif., or by checking the reply card.

Sewage Treatment Engineering Data Manual

511. This manual contains a brief outline of the various accepted methods of treating sewage and some of the problems, advantages and disadvantages of each. Check the reply card or write Smith & Loveless, Inc., Division—Union Tank Car Co., Lenexa, Kansas for design notes, charts and drawings.

Gas and Gasoline Engines Described in Literature

535. Roiline engines (formerly LeRoi), gas and gasoline models are built as bare engines, complete power units, and with components and accessories for special services. Check the reply card or write Waukesha Motor Co., Waukesha, Wisc., for details on the use of these engines in compressor, generator and pumping installations.

Valuable Information on Incinerator Stokers

505. The Combustion Engineering stoker is described fully in catalogue No. IS-1 which is available from Combustion Engineering, Inc., Combustion Engineering Bldg., 200 Madison Ave., New York 6, N.Y. Schematic drawings of the units, advantages of incineration, firing methods, design and performance are sections covered. Check the reply card today.

Design Manual on Sectional Plate Pipes, Arches and Pipe-Arches

550. Size and weight tables, minimum gages for live load strutted and unstrutted, layout details and plan developments are some of the material covered in this manual. Write American Bridge Div., United States Steel Corp., 525 William Penn Place, Pittsburgh, Pa.

Chemical and Slurry Feed Pumps

560. . . . are described in new booklet by that title which carries descriptions, illustrations and specifications of value in choosing such pumps. Write to Komline-Sanderson Engineering Corp., Peapack, N. J. Or you may check our card number for it.

Reinforced Concrete Pipe For Culverts and Sewers

672. Elliptical Lo-Hed and Hi-Hed pipes, round pipe and flat base pipe are described fully in literature from American-Marietta Co., Concrete Products Div., 101 East Ontario St., Chicago 11, Ill. Headwall details, discharge curves, hydraulic capacity tables and hydraulic properties are included. Check the reply card.

Better Blowers for Sewage Treatment Plants

685. Engineered to reduce maintenance and replacement costs. Seven design features incorporated to give you better results. Write for detailed specifications to Sutorbilt Corp., Dept. F, 2966 E. Victoria St., Compton, Calif., or use the reply card.

To order these helpful booklets check the r eply card opposite page 38.

STREETS AND HIGHWAYS

Road Rollers for Rent

81. Full details of the plan offered by well-known manufacturer of rollers are in handy little folder. Permits you to "roll without owning." Write for booklet DM-37 to Galion Iron Works & Mfg. Co., Galion, Ohio, or check our card-number.

Useful Attachments for "Payloader" Tractor Shovels

95. Increased versatility for Hough "Payloader" tractor shovels is made possible by the various attachments described in literature of the Frank G. Hough Co., 761 Seventh St., Libertyville, Ill. Illustrated and described are rotary "V" and trip-blade snow plows, hydraulic backhoe, back-filler blade. pickup sweeper, scarifier teeth, winches, etc.

New Street Sweeper Broom Filament

157. Keystrand is its name, and full description of its contribution to better street sweeping is given in folder that also contains a sample of this new polypropylene filament. Write to Keystone Plastics Inc., 280 Badger Ave., Newark 8, N. J., for yours, or check our card-number.

To Sweep a Better Street for Less

162. Find out about what Prostran can do to make your street sweeper brooms last longer, cut "down-time" and lower your cost per sweeping mile. A folder, with sample polypropylene filament is yours for the asking from E. B. & A. C. Whiting Co., Burlington, Vermont.

Insect Control and Soil Stabilization with One Unit?

191. Yes, if it's a Buffalo Turbine sprayer-duster that is used for dry or wet insecticides and finds application also in sand, dust and soil stabilization with lignin sulfonate. Several popular models, trailer or skid mounted, are described in literature of Buffalo Tarbine Agricultural Equipment Co., Inc., Gowanda, N. Y. Check reply card for your copies.

Don't Haul and Burn Brush, Dispose of It on the Spot

196. How you can do this the easiest way with Fitchburg Chippers is the theme of 16-page illustrated catalog that can save you work and grief. Gives experiences of others and describes simple mounting on truck body or on trailer, tractor or Jeep. Write Fitchburg Engineering Corp., Fitchburg, Mass., or just use reply card.

Illustrated Specifications on Brush and Limb Disposal

222. A new booklet on the modern approach to the brush problem shows how an Asplundh chipper reduces bulky branches and brush trimmings to chip size for mulch or easy removal. Write Asplundh Chipper Company, 501 York Road, Jenkintown, Pa.

Road Rollers, Scrapers, Distributors or Street Flushers . .

287. Whatever your need from fill to finish, there's a Seaman product to help you build better roads at lower cost. Before you do anything in this line or on soil stabilization write for specification sheets, to Seaman-Gunnison Div., Seaman Corp., P. O. Box 3025, Milwaukee 18, Wisc., or check our card-number.

To Make Your Street Sweepers More Efficient

332. Get this "Operating Recommendations" sheet showing correct broom settings and discussing common mechanical sweeper problems and how best to overcome them. For your copy, address Rynal Corp., 114 St. Joseph St., Arcadia, Calif.

Everybody Else May Have Automotive Battery Problems—

401. . . . except those who have read the Leece-Neville folders on their alternator-generator systems, and then done something about it. Have less trouble by taking the trouble to write for these bulletins, to The Leece-Neville Co., 1374 East 51st St., Cleveland 3, Ohio, or ring the card-number.

A Boon to Grounds Keepers

334. A trailer that hauls, unloads and reloads, hydraulically. Elevator lowers to ground level for one-man loading. Write for Bulletin GC-100 to Trailevator Div., Magline Inc., Box 57, Pinconning, Mich.

For Soil Sampling and Pavement Coring

576. There's an easier way to do both with Acker equipment. Bulletin 26-R describes a kit containing 12 different soil sampling tools. Bulletin 40-R tells about the All-Purpose auger for all types of sub-surface exploration. Bulletin 700-R illustrates the Acker Shear Test Kit for in-place shear tests in soft areas. Name the ones you want. Acker Drill Company, In. , Box 830, Scranton, Pa., or check our card.

Public Works Equipment for Everyday Use

578. How many everyday public works needs can be met by the products of one company is the basic content of this brief but informative brochure. Inform yourself with a copy of it. Address Allis-Chalmers Mfg. Co., Box 512, Milwaukee 1, Wisc., or ring the number on card herewith.

Here's a King-Sized Sucker-Upper . . .

656. . . . that will rid your streets and gutters of leaves, litter and other bulky materials in record time. Cleans catch basins to 8-ft. depth in minutes. Bulletin PL 758 S describes and illustrates this motorized Scavenger. Address Good Roads Machinery Corp., Minerva, Ohio, or circle number on card.

Design of Concrete Pavements For City Streets

657. Sections covered in this manual are classes of streets as to traffic, quality of concrete, working stress and safety factor, types of pavement design, design procedure, jointing of municipal pavements and use of distributed steel. Check the reply card or write Portland Cement Association, 33 West Grand Ave., Chicago 10, Ill.

To order these helpful booklets check the reply card opposite page 38.

SNOW AND ICE CONTROL

Uniform Salt Spreading Saves Material

42. The wide, thin pattern provided by Tarco "Scotchman" spreaders avoids salt waste, saves time and labor. Get Folder BL for full details on their spreader and table of material application rates. Use reply card or write Tarrant Mfg. Co., Dept. PW, Saratoga Springs, N. Y.

Engineering Data on Truck Mounted Snow Plows

116. Trip cutting edges, one-way plows, push frames and reversible snow plow moldboards are covered in literature from Flink Co., Streator, Ill. Check the reply card.

Snow Plows and Road Scrapers

128. Here is a ten-page illustrated booklet that no highway or street maintenance engineer or official will want to enter next winter without. Your copy, by the above title, awaits you free on request of Root Spring Scraper Co., Kalamazoo, Mich., or use our card.

Bare Pavement Maintenance With Sterling Rock Salt

158. Handbook is designed for road maintenance men who are responsible for safe winter pavements; and is a safe-roads fact book about a modern snow and ice removal program. Check the reply card or write International Salt Co. Inc., Clarke Summit, Pa.

Ice Control Without Corrosion Dangers

164. Virtually all corrosion is prevented when rust inhibitor "Banox" is used in conjunction with salt for snow and ice control. Properties of this material and performance results are described in bulletins issued by Calgon, Inc., Hagan Center., Pittsburgh 30, Pa.

Save on Winter Ice Control Cost

237. . . . with the faster-working salt described in this new Bulletin B-1159S. Tells what this salt will do and why, and where to get it. Also the bonus you get from using salt for summer road stabilization projects. Address Morton Salt Co., Industrial Div., 110 N. Wacker Drive, Chicago 6, Ill., or use our card.

Snow Plows For Every Need

294. Frink snow plows are designed to meet snow removal needs at airports, parking lots and streets and highways. They consist of four basic types with models to fit trucks 1½ to 12 tons. For complete data write Frink Sno-Plows, Inc., Clayton, N.Y.

Hydraulic Controls Make Snow Plowing Easier

368. Hydraulically operated power controls may be readily installed on trucks that will plow snow this winter. Start preparing now to make winter maintenance an easier job. Get illustrated folder from Monarch Road Machinery Co., 1331 Michigan St., N.E., Grand Rapids 3, Mich. Use the inquiry card.

No Idle Trucks with these Spreaders

397. New 8-page catalog gives features, specifications, users' statements on the Fox Mountable spreaders, equally good for sand, cinders, chips, salt, calcium chloride. Designed for one-man operation and year-round use. Wide widths and high speeds. Mounts or demounts in 15 minutes. Write Fox River Tractor Co., Box 469, Appleton, Wisc., or check our card number.

Snow Plows For Snow Control

539. V-type one-way and reversible plows with hydraulic hoist and having a plowing width of up to 9½ ft. are described in literature from Gledhill Road Machinery Co., Galion, Ohio. For models, specifications and features check the reply card.

Formulation for use in Thermal Snow and Ice Removal Systems

493. The properties and advantages of Dowtherm SR-1, a heat transfer fluid, and typical installation layouts are covered in catalog available from The Dow Chemical Co., Midland, Mich.

Salt, Sand and Cinder Spreaders

532. . . . are fully discussed in folder No. A-450 outlining how these are dump body mounted for quick attachment and detachment according to service and season. Basic specifications outlined. Just address Baughman Mfg. Co., Jerseyville, Ill. or use the reply card.

CONSTRUCTION EQUIPMENT AND MATERIALS

New Literature on Tractor Loaders

55. Full illustrated descriptions on Allis-Chalmers TL-12 and TL-14 Tractor Loaders are furnished in bulletins MS-1386 and MS-1373 respectively. Write Allis-Chalmers Construction Machinery Div., Milwaukee 1, Wis.

Prestressed Concrete Information

97. A complete profusely illustrated catalog covering use of prestressed concrete as a construction material for bridges, pressure pipe, tanks, and many other public works applications. Gives specifying data, too. Address American Steel & Wire Div., U. S. Steel Corp., Rockefeller Bldg., Cleveland 13, Ohio.

"Low Bid? Best Buy?"

144. Don't miss this penetrating analysis of the "Low Bid" fallacy, put out in tabloid form with some thought-provoking case histories included. Have this presentation of bid facts before your next letting. Ask for Form D111 from Caterpillar Tractor Co., Peoria, Ill.

To order these helpful booklets check the reply card opposite page 38.

The Versatile Jeep

333. Inform yourself of its many varied uses and advantages with the new 4-page in-color folder showing the full line, with major specifications. Address R. J. Kreusser, Fleet Sales Manager, Willys Motors Inc., Toledo 1, Ohio, or use reply card.

Selection of a Small Packaged Air Compressor

387. Catalog 1548 contains tabular and chart information on cu. ft. of air required to operate a variety of pneumatic equipment, average and continuous air supply tables and charts on ratios of compression and tables on flow of air through orifices. Check the reply card or write Ingersoll-Rand Co., News Service Dept., Phillipsburg, N. J.

Manual on Construction Castings

462. This 168-page Manual covers catch basin inlets and traps, building castings, manhole covers and steps, flap valves, wheel guards, drainage grates and many other construction and maintenance castings. Check the reply card or write Neenah Foundry Co., Neenah, Wisc., for your copy.

What Henry Didn't Know About Tractors and What It Cost Him

513. This is the theme of a "comic book" that has as much sound information and sense in it as it has laughs. And there are plenty of both. Moral: Ignorance is not bliss when it is costing the tractor owner money. Your men will appreciate it. For copies, write for "Henry's Crawler," to Advertising Dept., J. I. Case Co., Racine, Wis. or circle our reply card.

Specification Sheets on John Deere Tractors and Equipment

588. Information and specifications on the John Deere crawler and wheel-type industrial tractors and working equipment. Deere & Co., Industrial Division, Moline, Ill. Check the reply card. State type of tractor and equipment.

Complete Line of Asphalt Patching Mixers

586. Mixers capable of mixing 3 to 20 tons of hot mix per hour are described in literature available from McConnaughy Mixers, Inc., Lafayette, Ind. Check the reply card for full information on patching, repairing, resurfacing and sealing.

Literature on Concrete Gunning Equipment

695. The application of gunned concrete and allied equipment used for mixing the dry blend mix for this operation is described in Form No. C7-59, furnished by the Air Placement Equipment Company, 1000 West 25th Street, Kansas City 8, Missouri.

STREET LIGHTING AND TRAFFIC CONTROL

Steel and Aluminum Lighting Poles for Streets and Highways

74. Standard designs, assembly details, suggested pole sizes and base construction details are some of the information offered in Bulletin LS-29 (Steel) and Bulletin LS-30 (Aluminum). Check the reply card or write The Union Metal Mfg. Co., 1432 Maple Ave., NE., Canton 5, Ohio, for details covering the latest Monotube pole designs for modern streets and highways.

Finest Line of Markers for Fine Line Marking

165. Complete information on truck mounted highway markers, self-propelled line markers, all purpose line markers, and hand-propelled line markers is available from the M-B Corporation, New Holstein, Wis. Photographs and specifications of each type of line marker are included. For more, check the handy reply card.

Aluminum Traffic Control Devices

32. Is title of 24-page booklet covering every such device made of aluminum, from signs and sign blanks to panels, overhead structures and paint. Full specifications. For yours, just write Aluminum Co. of America, Alcoa Bldg., Pittsburgh 19, Pa., or use reply card.

Latest Data on Davits for Lighting Standards

77. Is in a just-issued 12-page catalog. In it are classified the various davits available by mounting height, appearance and arm extension. Ask for this booklet by name from Pfaff & Kendall, 84 Foundry St., Newark 5, N. J., or circle our card-number.

Lighting Standards for Every Outdoor Lighting Requirement

284. Complete design details, typical installation photos and how Stress-Spun standards are made are covered in this valuable guide. Check the reply card or write to the American Concrete Corp., 5092 North Kimberly Ave., Chicago 30, Ill., for Catalog 400.

Complete Line of Traffic Signals and Control Equipment

380. A full line of traffic signal and control equipment is covered in the comprehensive catalog of Econolite Corp., 8900 Bellanca Ave., Los Angeles 45, Calif. Wide choice of components offers economy and flexibility to suit future requirements. For more information write direct to Econolite or use the convenient inquiry card.

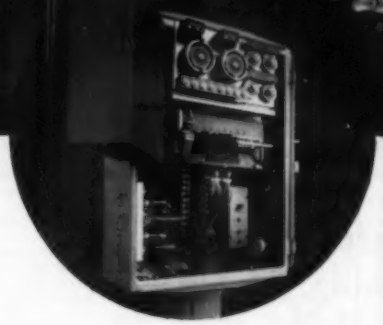
Let Progress Hit Your Highway Signs, too

575. An overlaid plywood especially engineered for highway sign construction is now available in natural surface for reflective overlays, also in green, white, red and blue. AASHO approved. Resistance to damage cuts maintenance costs. For GPX description and specifications write Georgia-Pacific Corporation, Equitable Bldg., Portland 4, Oregon.

20% MORE TRAFFIC...25% less congestion

in Minneapolis with EAGLE'S NEW "EC" SYSTEM

OLSON MEMORIAL HIGHWAY, Minneapolis, Minn.
(less than one mile from loop area)



THE "EC"
LOCAL CONTROLLER

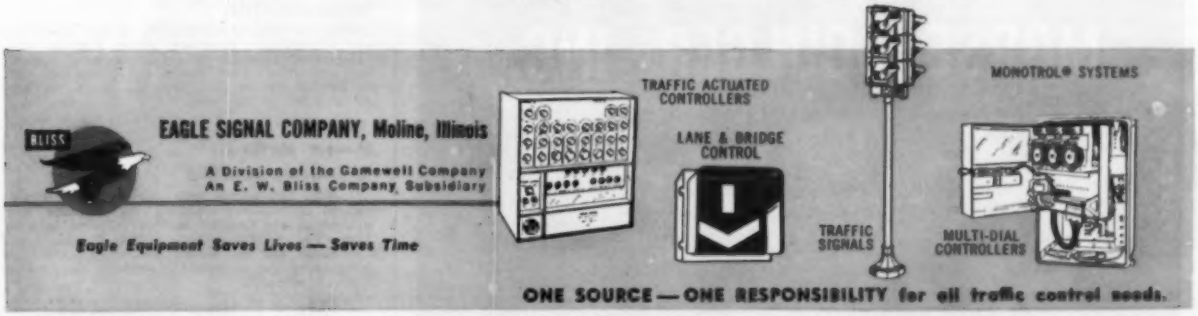
is similarly located at eleven intersections along a one mile stretch of one of Minneapolis' heaviest traveled areas. Each of the Locals is capable of receiving a minimum of 224 traffic function messages from the Master Controller and transferring these messages to the intersection's traffic signals.

MINNEAPOLIS REPORTS, "during peak traffic loads it is not uncommon for the volume density on Olson Memorial Highway to reach levels as high as 200% over normal periods.

"Nevertheless, a continuing series of surveys and on-the-scene checks now reveal that congestion has been reduced 25%.

"As the news of the reduced congestion spread, more and more of the city's rush hour motorists chose this route which they had previously avoided. Yet, traffic still moves faster and more freely than ever before, despite an overall increase of 20%.

"We have every reason to be more than satisfied with the performance of this new "EC" system. It has achieved a dramatic alleviation of what was rapidly becoming one of our worst traffic problems."



To order these helpful booklets check the reply card opposite page 38.

REFUSE COLLECTION AND DISPOSAL

Load-Packer 600 Points the Way to the Best in Refuse Collection

188. Bulletins W-200, W-220 and W-221 explain how the Gar Wood Load-Packer gives faster operation, bigger payload, more compaction, a larger hopper and more dependable operation. Write Gar Wood Industries, Inc., Wayne, Mich., or check the reply card.

Bulk Refuse Collection with or without Containers

192. A bulletin describing the bulk refuse system called the Roto-Pac Container System, which provides an unusual flexibility of service and the handling of all types of trash, is available from City Tank Corp., Culpeper, Virginia Check the reply card.

General Specifications for Refuse and Garbage Trailers

251. Two bulletins, one on the Pak-Mor 38 cu. yd. tandem axle trailer unit and the other on the Pak-Mor 32 cu. yd. trailer for use with Model GRD Dempster are available from Pak-Mor Manufacturing Co. Box 14147, San Antonio, Texas. General specifications, power train, operating procedures, maintenance and lubrication and other helpful information are included.

Select Your Incinerator Scientifically

275. Here is a new swift simple way of selecting the correct industrial, institutional or business-use incinerators for various types of installations. The device is somewhat like a slide rule and takes in the variable factors which determine choices in incinerators. Get yours from Morse Boulger Inc., 80 Fifth Ave., New York 11, N. Y., or check number on our card.

What You Should Know About Refuse Incineration

30. Two helpful bulletins tell what you should know about low cost refuse incineration for the small community and for larger cities. Your questions on mechanical stoking, burning rates and operating problems are discussed. Get Bulletins 217A and 223A from Nichols Engineering & Research Corp., 80 Pine St., New York 5, N. Y. Just check the reply card.

Where Does It Go From Here?

63. That is the title of new 12-page booklet, D 930, with thorough discussion of garbage disposal by sanitary landfill method. Read the latest report from the experts. Caterpillar Tractor Co., Peoria, Ill., or check card.

How to Construct A Sanitary Fill

331. A new 12-page booklet which tells the most efficient method of sanitary fill construction and furnishes complete information on planning and operation is now available from Drott Mfg. Corp., Milwaukee 15, Wis. Get your copy by checking the reply card; you'll find this booklet both interesting and valuable.

Prompt Service on Sweeper Refill Fibers

367. Here's a dependable source of power sweeper refill fibers, including domestic and imported types and gutter broom wire. To get all the data write A. Steiert & Son, Inc., Hatfield, Pa., or use our reply card.

Methods and Benefits of Sanitary Landfill

409. Information on Sanitary landfill methods, organization and necessary equipment with which to carry out the job is available from the Construction Machinery Div., Allis-Chalmers Mfg. Co., Milwaukee, Wis. Bulletin MS-1159.

Pushbutton Refuse Collection

469. Pushbutton control of the packing cycle is just one of the many features of the Mark II Collectomatic refuse collection unit. In addition the unit offers fast, safe loading; "Duo-Press" compaction; positive ejection without raising body; simplified maintenance. 13, 16 and 20 yd. capacities. For all details get Bulletin BH-60106 from The Heil Co., Milwaukee 1, Wisc. Use the inquiry card.

Progress in Refuse Removal

495. . . . registers a new high mark with the Hobbs Hyd-Pak 60 model. Gives lower loading height, watertight body, 3 "extra" yards all in one ultra-modern, proven piece of equipment. For details on this unit and a pick-up container system, address the Hobbs Hyd-Pak Division, 609 N. Main St., Fort Worth, Texas.

Best Way to Beat the Long Haul Problem on Refuse

547. . . . is fully described and illustrated in this new folder. Tells how your Dempster equipment containers can be converted for super-service. Gives you the step-by-step process to modernize what you have now. Write for Folder 6073 from Dempster Bros. Inc., Knoxville 17, Tenn., or just circle the number on our card.

Something New in the Incinerator Field

577. A reciprocating grate stoker described and illustrated. Brochure shows how it provides new answers to old incinerator operating problems. Just write for Pamphlet 701 to Detroit Stoker Co., Monroe, Mich., or circle number on the card.

Modern Methods in Sanitary Landfills

699. Up-to-date data, pictures and explanation of sanitary landfill, its methods and equipment are covered in this valuable bulletin from The Oliver Corp., 19300 Euclid Ave., Cleveland 17, O. Check the reply card for information on satisfactory garbage and refuse disposal methods.

(More listings on page 56)

WHAT A DIFFERENCE!

What a beautiful difference

P & K ALL-ALUMINUM LIGHTING STANDARDS

can make in any community

You're looking down Broadway, the main business street of Needles, California. Ordered by the City Council as part of a relighting program, the installation, made by the California-Pacific Utilities Co., consisted of twenty seven P & K 30 foot tapered aluminum lighting standards. As you can see from the photos above, the difference is immediately apparent. The result is greater safety for the community at night and the beautiful modern appearance of the new standards by day. Of course, no painting ever required. Why not write for P & K's new brochure ALS-5 for a wealth of helpful information in your street lighting plans.

P&K

PFAFF & KENDALL 84 Foundry Street, Newark 5, N. J.

Branch Sales Office: San Jose, California
In Canada: Powerlite Devices LTD., Toronto, Montreal, Vancouver
Export Representative: Philips Export Co., New York, N. Y.

How to cut highway grass

maintenance costs in half

Proved chemical growth retardant MH-30 practically eliminates mowing!

It is estimated that mowing grass areas along state and local highways costs a staggering $50,000,000 a year! And as more highways with larger grass areas are being built, state authorities find these costs constantly rising and are forced to divert an ever-increasing share of their budgets to grass control.

However, this trend can be and is being halted. MH-30, the highly effective chemical mower, has been used successfully for a number of years in England and by several of our States. In Connecticut, for example, MH-30 used on slope areas demonstrated a 50% saving... up to $35 per acre.

MH-30 can:

- greatly reduce grass maintenance costs
- significantly expand the power of your budget dollar
- free highway maintenance men for other vital tasks
- minimize hazards to traffic and maintenance crews

When sprayed on healthy grass, MH-30 is absorbed through the leaves, moves to the plant-growth center. Here it halts upward growth, practically eliminates the need for mowing, frequently promotes lateral growth for a thicker, lusher sod.

In addition, MH-30 provides two-way safety. No more toxic than table salt, its use will not endanger humans, animals or birdlife. It is non-irritating, presents no handling or drift problems. And, by cutting grass mowing to a minimum, MH-30 reduces the chances of injury to crews working on today's busy highways.

Look into MH-30. Get further information about this superior *chemical mower* now. See your Naugatuck representative or write: Dept. A, Elm Street, Naugatuck, Conn.

Watch For This Demonstration Truck...

It's one of a fleet of trucks that will be traveling the country, demonstrating the safety and ease of application, the economy and effectiveness of *chemical mowing* with MH-30. It also illustrates the ease of conversion of your equipment to this advanced grass control system.

This truck, operated by just two men... demonstrates five proven and effective ways of applying MH-30. Here we see the air-blast spraying method featuring a converted row-crop sprayer mounted on the truck's rear. This method gives effective coverage 70-80 feet from the highway shoulder. Other methods designed to cope with every conceivable contour, median, and obstacle condition have been engineered and will be demonstrated. *All equipment demonstrated is commercially available.*

Look for this truck in your area and be sure to ask your Naugatuck district officer or contact address below for a viewing of the new film, "*Chemical Mowing*," for documented proof of the economy, effectiveness, and safety of using MH-30 for grass control.

Naugatuck Chemical Division **United States Rubber**

DISTRICT OFFICES: Akron · Boston · Portland · San Francisco · Chicago · Detroit · Castonia · Los Angeles · Memphis · New Brunswick, N. J. · Latex Division, Dominion Rubber Company, Ltd., Montreal · CABLE: Rubexport, N.Y.

To order these helpful booklets check the reply card opposite page 38.

WATER WORKS

Vacuum Flash Evaporators for Large-Scale Production of Potable Water

21. How sea and brackish water can now be de-salted and utilized at a reasonable cost is the subject of two complementary brochures. Write for them to Richardsons, Westgarth 7 Co., Ltd., P. O. Box 2, Wallsend, Northumberland, England, or just use our reply card.

Push-Type Cast Iron Pipe Joint

22. New brochure describes and illustrates pipe with this important development known as American "Fastite" joint. Offered as a superior double-sealing single gasket type of joint. Book also contains full specifications. Address American Cast Iron Pipe Co., P. O. Box 2603, Birmingham, Ala., or check our reply card.

Propeller Meters For Dependable Water Metering Control

53. The complete line of Measure-Rite propeller meters are described in Bulletin MR-105 available from Measure-Rite, Inc., 4545 W. Brown Deer Rd., Milwaukee 23, Wis. Check the card for details on these accurate meters.

How to Select Right Angle Drives

62. Data-filled Catalog 31 & 32 of Johnson Gear & Mfg. Co., Ltd., 8th & Parker Sts., Berkeley 10, Calif., makes it easy to select the correct right-angle gear drive for deep well turbine and other vertical shaft pumps. Includes details on the Johnson "Redi-Torq" gear drive. To get your copy just check the reply card.

For Fast, Smooth Pipe Cuts

68. Descriptive literature on the Reed 4-wheel hinged pipe cutter which operates in close quarters, gives quick, easy right-angle cuts, and is available from Reed Mfg Co., Erie, Pa. Check the reply card.

New Ring-Tite Joints on Valves and Hydrants

61. . . . are described and illustrated in new folder, for use with Transite pressure pipe. Tells how these joints eliminate need for special fittings with attendant extra labor and materials. Write for Bulletin RT-53 to The A. P. Smith Mfg. Co., 545 No. Arlington Ave., East Orange, N. J., or just circle number on card.

100 Page Book Helps Solve Water Problems

71. pH and Chlorine Control. A discussion of pH, Chlorine and Phosphate Control and descriptions of comparators for making colorimetric analyses. A 100 page booklet is available by checking reply card. W. A. Taylor & Co., 7304 York Road, Baltimore 4, Md.

High Frequency Resistance—Welded Steel Pipe. .

72. Available in 6" to 16" diameters, in wall thickness to .219, special wrappings and coatings available. For attractive booklet, including specifications and details of field joints write Valley Mfg. Co., Valley, Neb., or circle our inquiry card.

Study First, Then Dig

92. "Typical Pipe Detection Problems" is the title of this 24-page illustrated booklet that can save you a lot of guessing and blind digging by studying it first. For your copy write Tinker & Rasor, 417 Agostino Road, P. O. Box 281, San Gabriel, Calif. or circle our number on card.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

Water and Waste Treatment Instrumentation

93. Concise descriptions of all components used for pneumatic instrumentation and control of water and waste treatment operations, including primary measuring devices, transmitters, recording controllers and valve actuating devices are presented in a useful and convenient form in Bulletin 1-15A of The Foxboro Co., Foxboro, Mass. Check the inquiry card.

Split-Case Centrifugal Pumps

111. . . . for general water supply, with extra large capacity. 4-page folder contains wealth of information and specifications. Output ratings up to 4000 gpm for service against heads up to 400 ft. Write for Bulletin No. 1200 to Weinman Pump Mfg. Co., 290 Spruce St., Columbus 15, Ohio, or use our reply card.

AWWA Fire Hydrants and Gate Valves

155. Above-ground maintenance Mueller AWWA improved fire hydrants and minimum maintenance Mueller AWWA non-rising stem gate valves are described in literature from Mueller Co., Decatur, Ill.

Engineering Data On Mechanical Joint C.I. Pipe

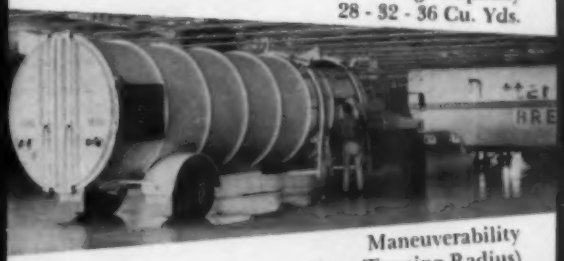
183. General specification, weights and dimensions of mechanical joint cast iron pipe and fittings are furnished in a 32-page booklet issued by Alabama Pipe Co., Anniston, Ala. Get this helpful data by checking reply card.

Manual on Filter Bed Agitators

206. General information-specifications and installation data regarding the application of Palmer agitators, or rotary surface wash in vertical and horizontal pressure filters—round, square and rectangular open gravity type filters are covered in Manual from Palmer Filter Equipment Co., 822 East 8th St., P. O. Box 1696, Erie, Penna. Check the reply card.

THE PLUS FEATURES ...THAT SUBTRACT FROM YOUR COST

Large Capacity
28 - 32 - 36 Cu. Yds.



Maneuverability
(Short Turning Radius)

Reach-ability
No Container Jockeying

Low Overhead Clearance

A New Container System—PAK-MOR's Handi-Lift teams with the Lo Boye's proven performance and gives you a Trailer Load at lower operating costs!!

Lo Boye Trailers have proven their big load abilities on commercial and residential routes. Now you have the plus of the Handi-Lift Container System with a reachability of six foot. All this adds up to bigger profits for you! Find out how you can do more—in shorter time — with a lower initial equipment investment . . . We'll be glad to show you how this combination can make money for you. . . . Write for details!

SANITATION FOR THE NATION

PAK-MOR
MANUFACTURING COMPANY

1123 S. E. MILITARY DRIVE PO BOX 14147 SAN ANTONIO, TEXAS

To order these booklets check card opposite page 38.

Manual Answers Your Water Meter Questions

440. This valuable reference covers the complete line of Trident water meters, giving full descriptions of each type and providing also helpful background information on metering and its advantages. Get your copy of the 28-page Trident Water Meter Catalog. Form 421-1, by checking the reply card or write to Neptune Meter Co., 19 West 50th St., New York 20, N. Y.

Manual on Pipe Finding Techniques

213. A manual on special pipe finding and leak detecting techniques of interest to utilities, municipalities, oil and gas companies is announced by Fisher Research Laboratory, Inc., 1961 University Ave., Palo Alto, Calif. The manual contains a number of articles on locating buried pipes and cables and detecting and locating fluid leaks in pipe lines.

Meters and Instruments For Water Works

224. An attractively arranged 40 page catalog in full color issued by Hersey-Sparling Meter Co., 225 No. Temple City Blvd., El Monte, Calif., furnishes concise data on the full line of Sparling meters, indicator-totalizer-recorder instruments and other special instruments and controls. Check the reply card for your copy, or write for Bulletin 314.

Welded Steel Pipe

226. 40-page booklet with pictures, product data, and specifications, plus tables on flows, pressures and every pertinent detail connected with this pipe. Ask for Catalog WSP-859 from Armco Drainage & Metal Products, Middletown, Ohio, or check the inquiry card.

To Meet Increasing Water Demands, These Two Steps Will help

247. Two new products designed to help meet constantly increasing demands for water are described in a folder of Hersey-Sparling Meter Co., 250 Elm St., Dedham, Mass. These are a flow analyzer that provides strip chart rate of flow and volume records, and a two-rate register that can be substituted for the flow analyzer. Get this data by checking reply card.

Outline of Modern Water Treatment Equipment

248. Bulletin 4433 is recommended for engineers who need a basic refresher course on treoatment of municipal and industrial water. It lists water impurities and methods of treatment and illustrates treatment systems and equipment. Check the reply card or write The Permutit Co., a Division of Pfaudler-Permutit Inc., 50 West 44th St., New York 36, N. Y., for your copy.

A Quick Comparison of Water Meters Helps

274. That is the purpose of the new bulletin describing the newest accomplishments in water meter design and manufacture. With it comes a Condensed Catalog of the Rockwell line. Ask for Bulletin No. W-811 from Rockwell Mfg. Co., Municipal & Utility Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.

Diesel Engines For Municipal Power Needs

359. Dependable power for water supply or flood control pumping stations, stationary or portable electric plants and many other municipal needs can be provided by engines described in literature of the Enterprise Engine & Machinery Co., P.O. Box 2161, 550 85th Ave., Oakland 21, Calif.

Helpful Data on Swimming Pools

364. Data on injector nozzles for complete recirculation, fittings for correct drainage and other useful information for pool design are covered in Manual SP issued by Josam Mfg. Co., Michigan City, Ind.

Gate Valves

369. A new publication has been issued especially for designers of sewage and waste treatment plants. Write for Circular No. 24 to M & H Valve and Fittings Co., Anniston, Ala., or check the card-number.

Are You Using the Right Coagulant?

381. This question, and its answer, are included in new folder that packs much valuable guidance in water and sewage treatment. Read a little and learn a lot. Write to Tennessee Corp., Box 2205, Atlanta 1, Ga., or circle our card-number.

Water Works Couplings, Clamps and Sleeves

426. Fully described in useful 24-page booklet covering all your pipe needs. Ask for "Water Works Catalog" of Dresser Mfg. Div., Bradford, Pa., or just circle the number on this card.

Vertical Turbine Pumps

508. . . . with a history of low maintenance costs and practically no service calls. These data are offered you in the helpful literature to be had from The Deming Co., 293 Broadway, Salem, Ohio. Check number on inquiry card.

Handbook on How to Lay Concrete Pressure Pipe

524. Manual on concrete pipe laying instructions is available from Price Brothers Co., Dayton, Ohio. Check the reply card for information on how to dig the trench and handle the pipe, make the joint and the pipe bedding procedure.

Kohler Standy-by Units Protection Against Power Failures

602. Dependable Kohler electric plants provide uninterrupted power for vital services when regular sources fail. Kohler Electric Plants World-Wide, folder E-402, illustrates models available for stand-by, sole supply, portable and marine applications. Sizes from 500 watt to 115 kw, gasoline, gas or Diesel operation. Write Kohler Co., Kohler, Wisconsin, or use the reply card.

Streamlined and Modernized Fire Hydrants

607. Models, dimensions and advantages of the Eddy fire hydrant are covered in bulletin from the Eddy Valve Co., Waterford, N. Y. Check the reply card for complete details.

Water Storage Review

617. Contains interesting picture stories of the various capacities, styles, shapes and appearances of steel water storage tanks. For your copy just write Steel Plate Fabricators Association, 105 W. Madison St., Chicago, Ill., or use our reply card

Air Control Valves For All Types of Pipelines

620. Literature on Crispin Air Valves, which safely control air in lines handling liquids, to maintain efficient operation and prevent expensive failures, is available from Multiplex Manufacturing Company, Dept. C, Berwick, Pa. Write today for your copy of the Crispin Air Valve Catalog, which offers complete information on the full line of dependable Crispin Air Valves.

Water Service Hydrants and Outdoor Drinking Fountains

661. Water service hydrants in 4 sizes, ¾", 1", 1¼" and 2" and all types of outdoor drinking fountains are described in a well-illustrated, 24-page catalog from The Murdock Mfg. & Supply Co., 426-30 Plum St., Cincinnati 2, O.

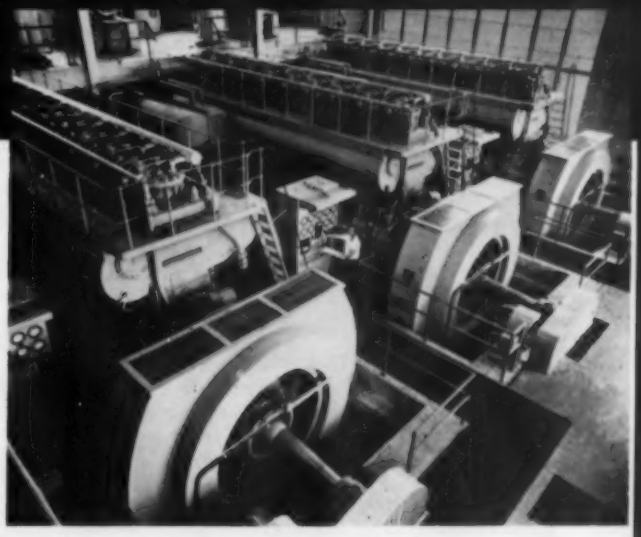
Turn Your Water Meter Reading Inside-Out

671. The Visi-Meter is a remote recording and indicator system that eliminates the need of entering the home to read water meters. It records within an accuracy of 0.1 percent. Check the reply card or write Visi-Meter, Inc., 301 North 17th St., Kansas City, Kans., for

Electronic Locators for Water Mains, Services, Valves and Boxes

677. Miniaturized line locator that is encased in a molded glass fibre container and has transistors that have a rated life of 70,000 hours and weighs only four lbs. when completely assembled is described in literature from Wilkinson Products Co., 3067 Chevy Chase Drive, Pasadena 3, Calif. Check the reply card.

HOUMA LIGHTS ITS WAY with Nordberg engines totaling 25,350 hp



Houma, long known as the shrimp center of Louisiana, has built its municipal power plant around Nordberg engines . . . and has eliminated the necessity for purchased power.

Power demands in Houma have grown steadily since 1949 when the first three 2,000 hp Nordberg natural gas burning engines were added to their 2,900 hp plant. Today, with only two of the original five oil burning engines in use, Houma's 15,800 kw peak load is satisfied by an additional four Nordberg units, the last three being big 10 cylinder, dual fuel engines rated at 5,250 hp each.

When *you* need *long term, dependable* power, consult Nordberg. See why there are so many *repeat orders* like those for the City of Houma for Nordberg Diesel, Duafuel, and Spark-Ignition gas engines, in sizes to over 12,000 hp.

INSTALLATION DATA:

1949—Installed 3 Nordberg 2,000 hp engines.
1954—Installed Nordberg 3,600 hp engine.
1959—Installed 3 Nordberg 5,250 hp Duafuel engines.

NORDBERG MANUFACTURING COMPANY • Milwaukee 1, Wis.

ATLANTA • CLEVELAND • DALLAS • DULUTH • HOUSTON • KANSAS CITY • MINNEAPOLIS • NEW ORLEANS • NEW YORK • ST. LOUIS
SAN FRANCISCO • TAMPA • WASHINGTON • WICHITA, KAN. • TORONTO • VANCOUVER • JOHANNESBURG • LONDON • MEXICO, D. F.

P161

No. 1 in a series of announcements on new HOUGH *machines*

The NEW 1¼ cu. yd. H-30 is even more

outstanding

than ever before with 25% greater capacity, many refinements, and additional features

When the H-30 was originally introduced, more than a year and a half ago, it was far ahead of any other tractor-shovel in its class. It has been exceptionally well received and its performance has been praised by owner and operator alike.

Now, as the result of HOUGH's continuing program of research, development and improvement, the new H-30 series "B" model is an even better machine. Here are a number of points of special interest . . .

More Capacity: With a 1¼ cubic yard bucket, this new model has 25% more capacity. At the same time, the exceptional stability and balance of the original H-30 unit has been retained.

More Safety: The only loader in its class with boom arms positioned ahead of, and away from operator. It has a walk-in operator compartment, new hand rails and safety ladder, new adjustable bucket seat, and unmatched operator visibility.

Less Maintenance: The only loader in its class with simplified boom mechanism and single bucket tilt cylinder having from 6 to 12 fewer pivot and grease points to service. All bucket and lower boom-arm pivot points are sealed against dust and dirt. The battery, instrument connections, fuel tank and transmission can be serviced from ground level. A stock of only 4 different hoses will service all the hydraulic system.

More Power: The H-30B has more horsepower-per-pound of weight than comparable tractor-shovels. Torque-converter is engineered to proportion engine power properly between drive-train and hydraulic requirements.

Better Braking: The four wheel hydraulic brakes give equal braking in forward or reverse and are sealed against dust and dirt. Exclusive HOUGH axle design permits servicing and relining brakes without removing and exposing planetary hubs to dust.

Full Power-shift Transmission: The only loader in this class with a "full" power-shift transmission which does not require stopping and engaging gears for a "range" shift. There are three speeds, both forward and reverse, and all shifts in either direction can be made "on-the-go." This dependable HOUGH transmission has been proven in thousands of PAYLOADER units.

Closed Hydraulic System: This exclusive HOUGH protective feature adds longer life and lower maintenance because the hydraulic reservoir is sealed and pressure-controlled to exclude air-borne dust and moisture. A full-flow, fine-mesh screen and a larger cartridge-type filter give extra hydraulics protection.

Positive Oil Cooling: Separate fan-cooled oil-to-air radiator assures positive cooling of both transmission and torque converter oil even in hot climates. Another exclusive HOUGH protective feature.

"Operator's-choice" Braking: Dual brake pedals give the operator a choice of braking with or without transmission engaged. The only loader in its class with this valuable HOUGH-pioneered feature.

"Power-transfer" Differentials: Both axles are equipped with torque-proportioning differentials. When one wheel has better traction than the other on the same axle, it can automatically receive up to 38% more torque. This assures the best possible traction at all times.

The H-30 series "B" is offered with a choice of gasoline or diesel power and with buckets from ¾ to 2½ cubic yard capacities (S.A.E. rated) for handling materials of various weights. For additional information, see your HOUGH distributor or use the attached coupon.

THE FRANK G. HOUGH CO. 9-B-1
761 Sunnyside Ave., Libertyville, Ill.

Send complete data on H-30B PAYLOADER

Name _____

Title _____

Company _____

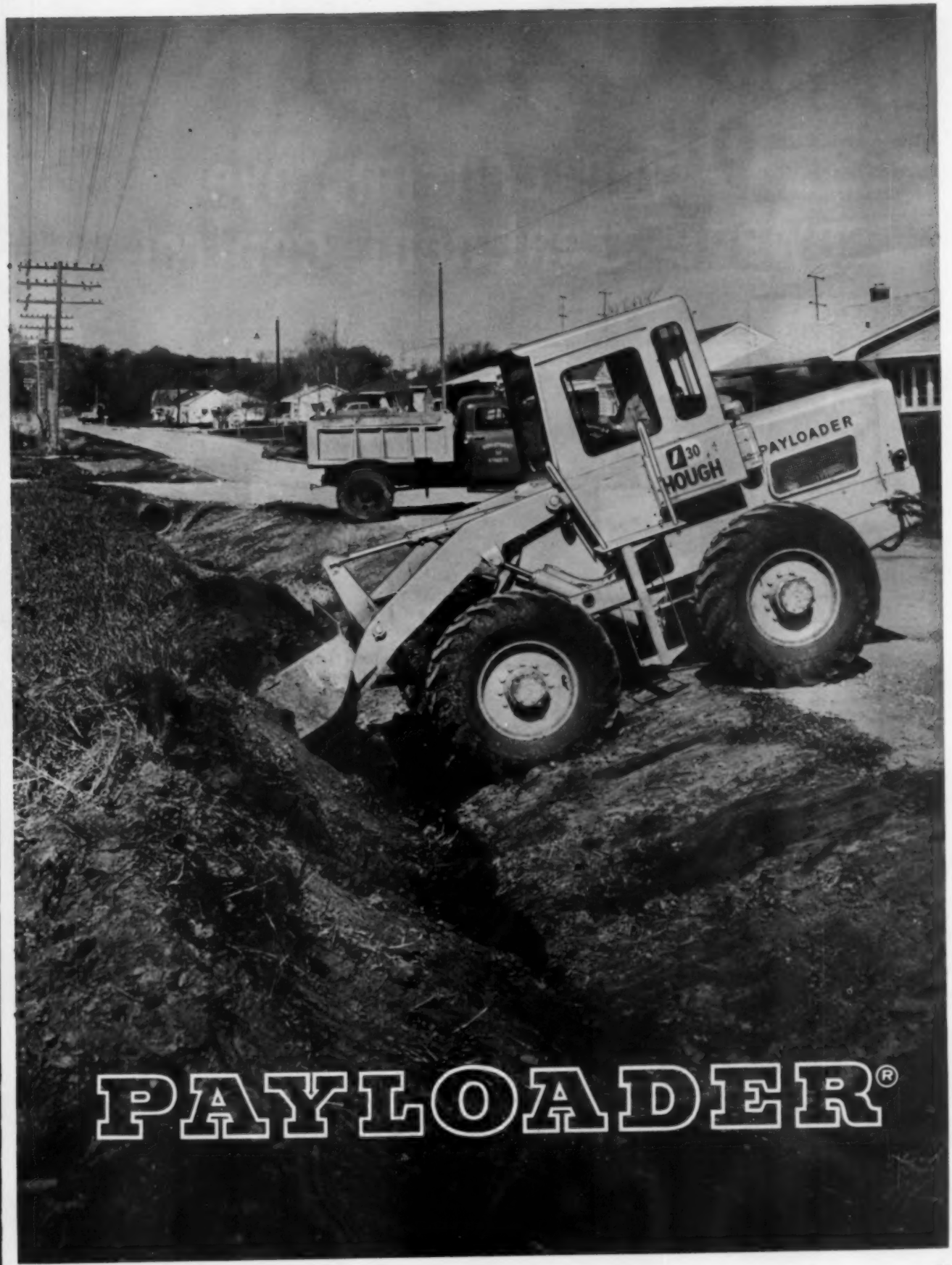
Street _____

City _____ State _____

HOUGH®

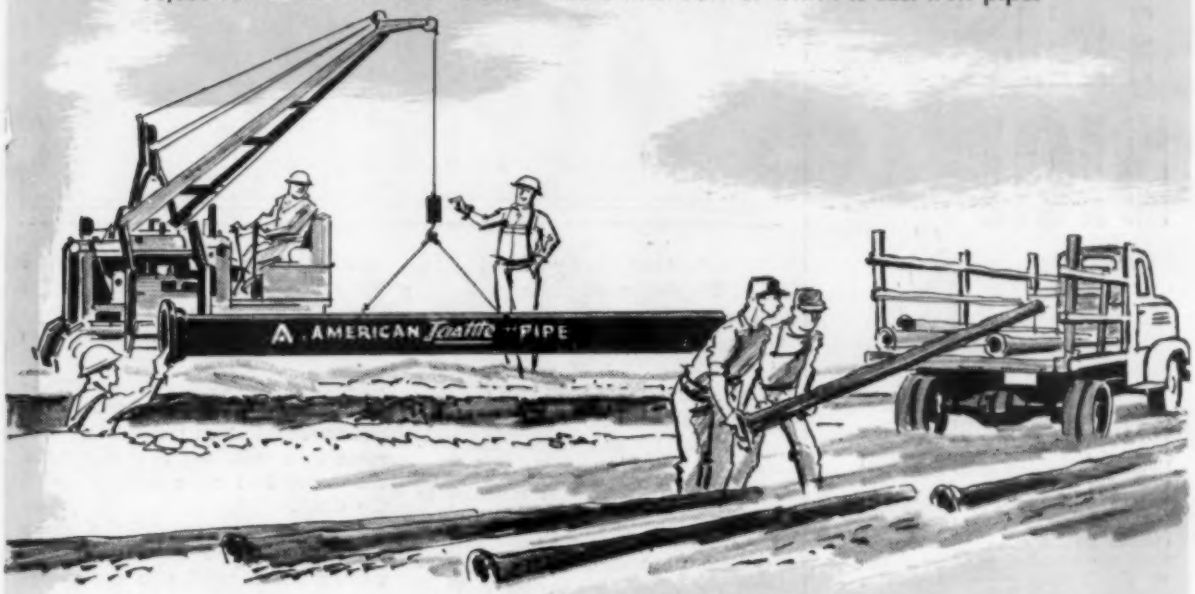
THE FRANK G. HOUGH CO.
LIBERTYVILLE, ILLINOIS
SUBSIDIARY – INTERNATIONAL HARVESTER COMPANY

HOUGH, PAYLOADER, PAYDOZER, PAYMOVER, PAYLOGGER, PAYLOMATIC and PAY are registered trademark names of The Frank G. Hough Co.


HOUGH
PAYLOADER
PAYLOADER®

PIPE FACTS

The 100 largest cities in the United States, surveyed recently, have more than 95,000 total miles of water mains — more than 90% of which is cast iron pipe!



DO YOU KNOW that when larger distribution mains are needed, the smaller mains can be reclaimed for years of additional service...if they are cast iron?

In Reading, Pa., for example... seven miles of cast iron pipe was taken up and relaid – saving about $350,000. Rarely, if ever, is composition pipe taken up and re-used.

DO YOU KNOW that cast iron pipe is designed to withstand expected water hammer shocks which can burst weaker mains? In tests, it required 3,400 psi water pressure to burst 6" Class 150 AMERICAN pipe. Composition pipe of similar size and class failed at 770 psi.

DO YOU KNOW that industry requires large volumes of water...and it must be economical? For most new industrial plants, water is the most important natural resource needed. In the long run, cast iron pipe delivers water cheapest of all.

DO YOU KNOW that the AMERICAN Fastite Joint requires no calking? Its only joint component is a dual hardness, easily-inserted, double-sealing rubber gasket. A minimum of labor and equipment is needed to install Fastite pipe...and the extra minutes saved soon total up to additional dollars saved in installation costs.

*Patented conductive gasket

AMERICAN CAST IRON PIPE COMPANY
BIRMINGHAM ALABAMA

LEGAL ASPECTS OF PUBLIC WORKS

MELVIN NORD, Dr. Eng. Sci., LL.B.

Construction by Direct Employment of Labor

Jibben v. City of Sioux Falls, 109 N. W. 2d 252, a South Dakota case decided May 17, 1961, was an action for an injunction restraining the city from constructing water and sewer extensions by the direct employment of labor, instead of letting contracts to the lowest responsible bidders. The Supreme Court of South Dakota held that the statute providing that all contracts for construction of public works and all contracts for local improvements, for which special assessments are to be levied, must be let to the lowest bidder did not prohibit the city from constructing local improvement, for which no special assessments were to be levied, by labor regularly employed.

Drainage Ditch Overflow

Baum v. County of Scotts Bluff, 109 N.W. 2d 295, a Nebraska case decided May 19, 1961, was an action by a property owner against the county and the Gering-Fort Laramie Irrigation District for damages to growing crops and personal property as a result of flooding allegedly caused by a steel sheet placed in the drainage ditch by defendants to retard the flow of water in it. The object was to stop the ditch from washing wider and deeper, by retarding the flow of water, and thus to prevent the washing out of the approach to a highway bridge which crosses the ditch 50 feet away from the location of the steel sheet.

On various occasions, the ditch overflowed, covering plaintiff's land to a depth of two feet in some instances.

A civil engineer and surveyor with considerable experience as an engineer in irrigation and drainage work testified that he designed the structure in question, and that the reason the opening in the structure did not need to be as large as the ditch was that the water falling over the piling and having room to drop down would gather velocity and that would require a considerably smaller area than the ditch back of the structure; and that the opening was more than sufficient to take care of the water that came down through the ditch.

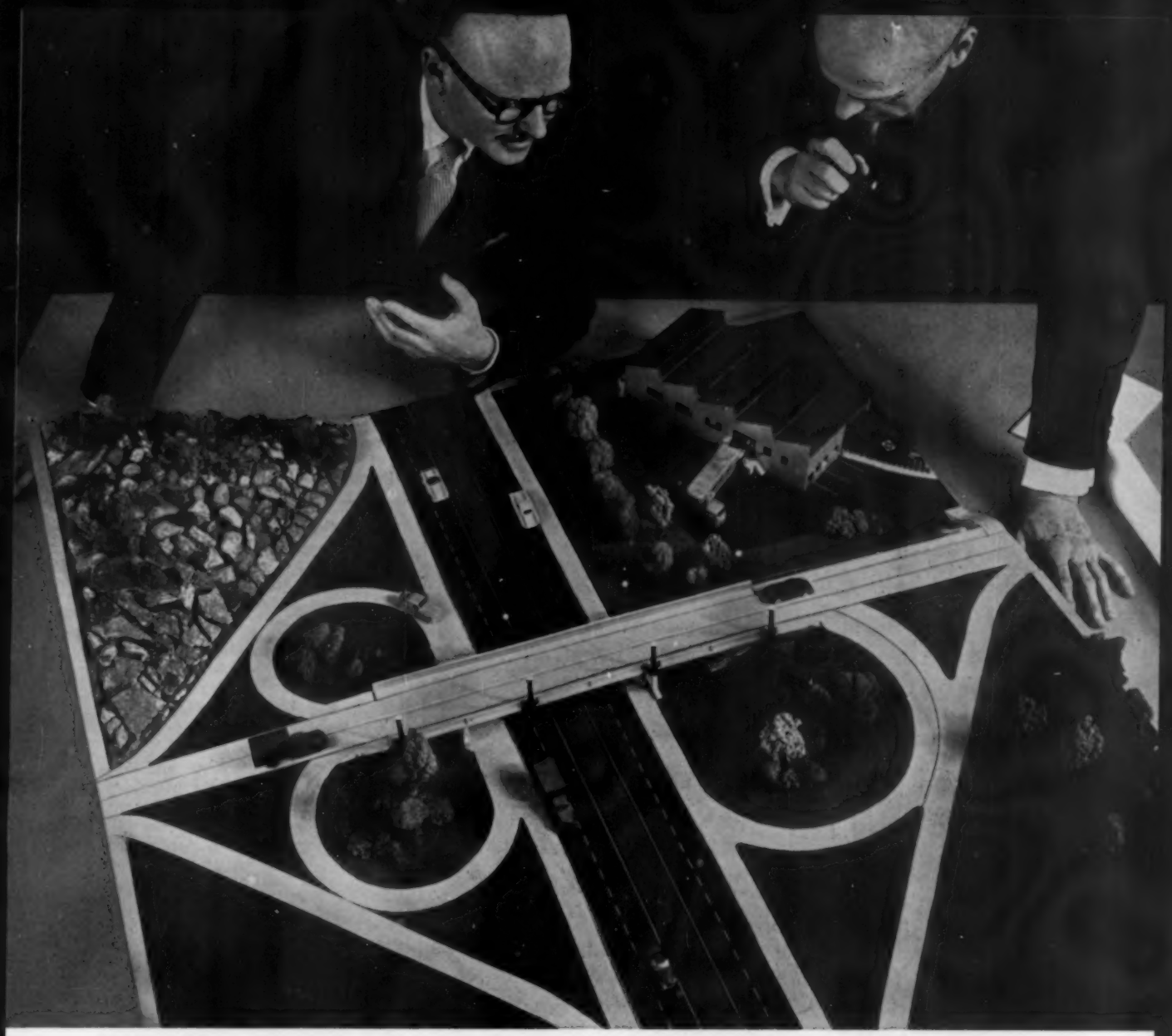
Another witness testified that on one occasion, he had found two trees stuck crosswise in the structure. After prying them loose, the structure took all the water and flooding was stopped.

The case went to the jury, which returned a verdict in favor of the defendants, on the ground that it was not shown by plaintiff that the opening in the structure was too small to carry the water and debris that could reasonably be expected to come down the ditch in times of heavy rainfall. On appeal, the jury's verdict was affirmed.

Icy Sidewalk

Hall v. City of Anoka, 109 N. W. 2d 319, a Minnesota case decided May 19, 1961, was an action to recover for injuries sustained by plaintiff when she fell on a public sidewalk.

On December 6, 1955, at approximately 4:30 p.m., the plaintiff Hazel Hall fell on the sidewalk in front of the Herald building in Anoka. She claims that the fall was occasioned by ridges and bumps in snow and ice which the defendant city had allowed to accumulate and compact on the sidewalk. On the first trial of this case, the court directed a verdict in favor of the defendant. On appeal, this was reversed, the Supreme Court of Minnesota holding that the evidence of the defendant's negligence raised an issue of fact for the jury. On retrial, the jury gave a verdict



When it comes time to appoint a trustee or fiscal agent for revenue bonds, The Chase Manhattan Bank is at the service of state, county and municipal authorities. Chase Manhattan has the staff and experience to handle this function as trustee or fiscal agent in cooperation with banks in the areas where the projects are located. For complete details write: Corporate Trust Division, The Chase Manhattan Bank, 1 Chase Manhattan Plaza, New York 15.

for the plaintiff. On appeal, the Supreme Court of Minnesota held that failure of the court specifically to instruct that the defect must have existed a sufficient length of time for it to have been reasonably discovered and corrected, was not prejudicial error where the court instructed that the city was under a duty to exercise reasonable care in keeping its sidewalks in a reasonably safe condition for pedestrians, and defendant neither requested nor called to court's attention its failure to instruct more specifically on the length of existence of the defect.

• • •

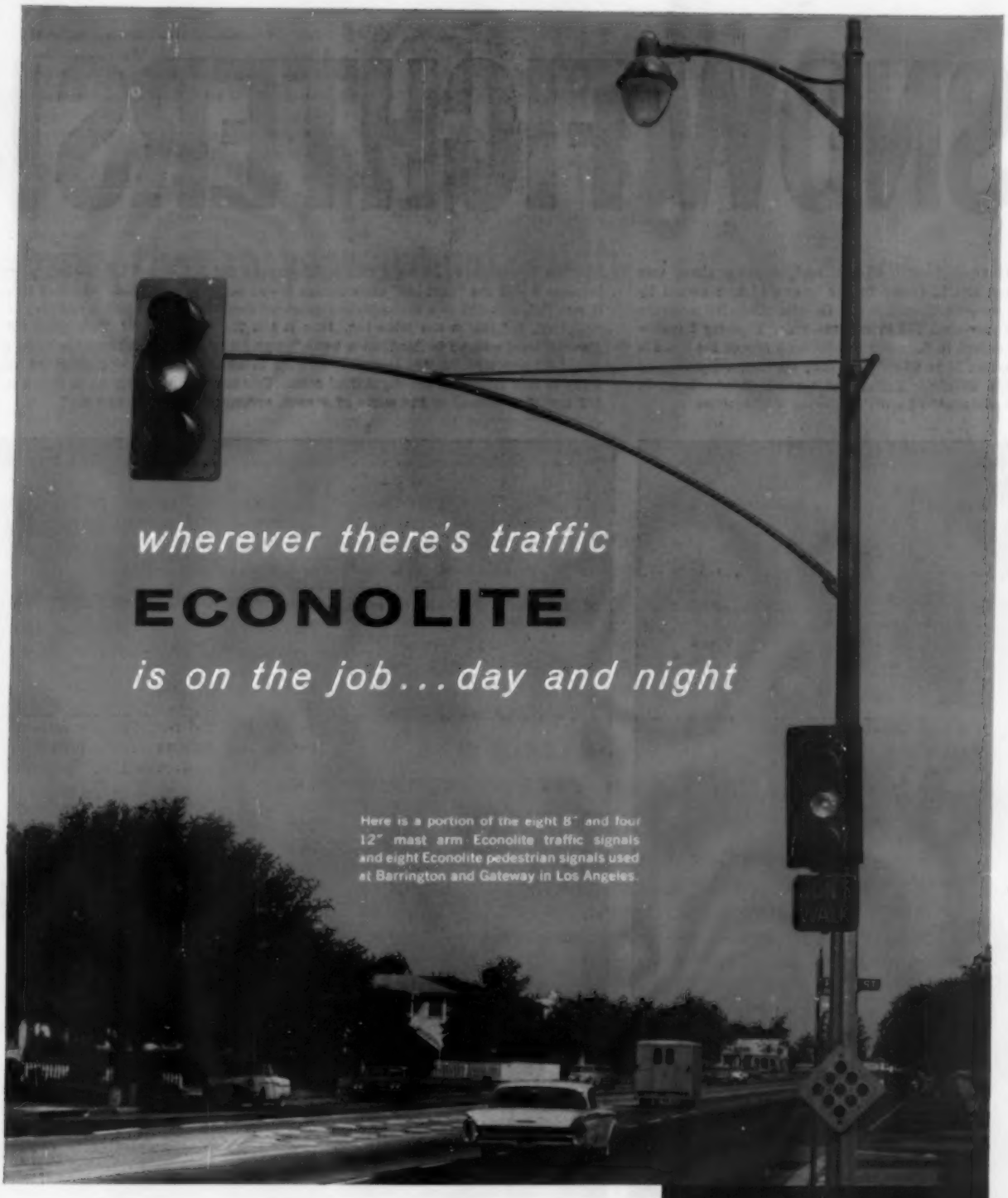
Purchase of Used Equipment by Cities

A questionnaire to city engineers and directors of public works asked two questions: Do you ever buy *used* construction and/or maintenance equipment? If so, do you buy on specification?

To the time this tabulation was made 1250 replies, representing 22 percent of the questionnaires mailed, had been received. Based on these returns, which covered all 50 states, 559 cities reported they did buy used equipment and 513 stated they did not. Since a serious problem in buying used equipment is preparing a specification that will protect the public, it is interesting to note that 250 cities reported they did buy on specification whereas 261 said they did not. However, these data appear open to some slight question.

While there does not seem to be any strong pattern, a tabulation of replies from the six New England states showed that only 44 out of 120 cities replying bought such used equipment; in the North Atlantic states only 64 of 180 bought used equipment; but in Ohio, Michigan and Wisconsin 98 of 180 reported buying used equipment.

The replies on buying on specification appear to be not entirely reliable. This is due to the fact that some respondents reported that their cities did not buy used equipment or made an indefinite statement regarding their practices and then also replied "no" to the question "do you buy on specification?" It was not always possible to separate these for tabulation, though special care was taken to do so. In all there were 559 cities reporting the practice of buying used equipment and 511 reporting on specifications—250 buying on specifications and 261 not doing so.



THE CITY OF LOS ANGELES

is doing everything possible for drivers and pedestrians. Many Econolite traffic and pedestrian signals and controls are used in directing and controlling the flow of traffic throughout this large metropolis. Likewise cities both small and large in all parts of the United States and many foreign countries use Econolite. No matter what your traffic problem, write for detailed information.

ECONOLITE CORPORATION

Factory and general offices
8900 Bellanca Avenue
Los Angeles 45, California

SNOW FIGHTERS!

Clearing four inches of early-morning snow, this Cat No. 12 Motor Grader is one of four owned by Lawrence County, South Dakota. Snowfall averages better than 100 inches per year. Highway Superintendent R. A. Curtis reports each one of the No. 12s clears 50 to 60 miles of road per day, depending on the snowfall. During the summer they're used to maintain the county's 420-mile road system.

Winslow Township, Pa., bought this multi-purpose Cat 922 Wheel Loader last year because it was the "best bid" even though it was not the lowest bid. The best bid, it was felt, was the one that provides years of dependable, low-cost service – low final cost, not just a low price tag. How is the 922 working out? "It's great for plowing snow – much better than a truck," says Newell Sprague, Township Supervisor. "It plows and clears ten miles of road in eight hours – making as many as three or four passes in heavily drifted areas. One big advantage for us is that the 922 can turn around in the width of a road, something no truck can do."

...and you don't have to mothball these Cat-built machines in the spring—they're year-around, multi-purpose road maintenance tools

It's a tough decision. When the snow falls every responsible public official knows that he's got to have effective snow removal equipment out keeping vital roadways open. But does he have to buy expensive special equipment? Can he afford to?

Emphatically no! Many cost-conscious governmental bodies are switching to versatile, year-around Caterpillar Wheel Loaders and Motor Graders for snow removal work. Matched with snow attachments, these powerful rigs are built for blizzard-breaking performance. And taxpayers get a real bargain: *12-months-a-year* road maintenance by Caterpillar equipment . . . for fewer tax dollars. Less equipment to maintain, too.

For handling snow up to six inches deep, many municipalities, counties and townships use Cat Motor Graders with a standard blade and wing. This rig clears a path 20 feet wide in one sweep. For deeper snows a V-type plow can be mounted out front with the wing used to cast snow off to the side. Even with the extra attachments, a Caterpillar grader costs less than a heavy, special snow removal truck, and the grader is much more versatile.

The three new Cat Wheel Loaders work smoothly in snow clearance because of their excellent balance and traction. Buckets, from 1¼ to 4 yd., are fine for dozing and loading out snow. The exclusive Cat Side Dump Buckets are designed for fast, easy truck loading—leave cleared lanes open for traffic while loading. A multi-use tool, they dump to left or forward. In heavy snows a V-type plow can be quickly mounted on Cat Wheel Loaders. With this attachment the loaders can drive into big drifts, lift the plow swiftly—because of Caterpillar's powerful live-action hydraulics—and rip up the snow. They can often break through drifts faster than a big truck with a V-plow.

These loaders and graders make an effective team. Road officials often schedule a motor grader to open streets quickly, with a loader in the rear to load out the snow. Or in the case of bad drifts, a V-plow equipped loader breaks through followed by a grader for the final cleanup. For loading out the snow, the V-plow can be removed from the loader and the bucket replaced in minutes.

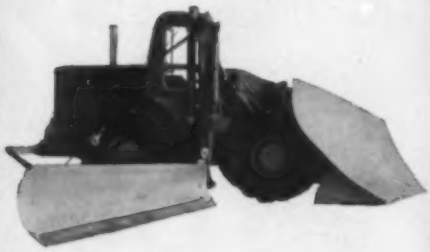
If you need snow removal equipment, talk to your Caterpillar Dealer. He can show you the dollars and cents advantage of using versatile equipment—machinery that can handle your snow removal *and* your year-around road maintenance. Do business with the man whose business is built on dependability.

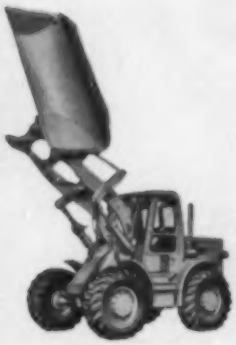
Caterpillar Tractor Co., General Offices, Peoria, Illinois, U. S. A.

CATERPILLAR

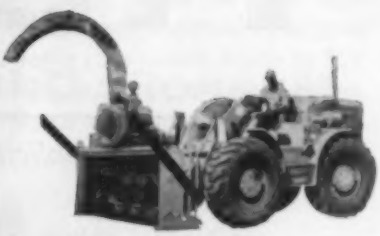
SNOW FIGHTING ATTACHMENTS FOR CATERPILLAR EQUIPMENT

V-type Plows and Wings

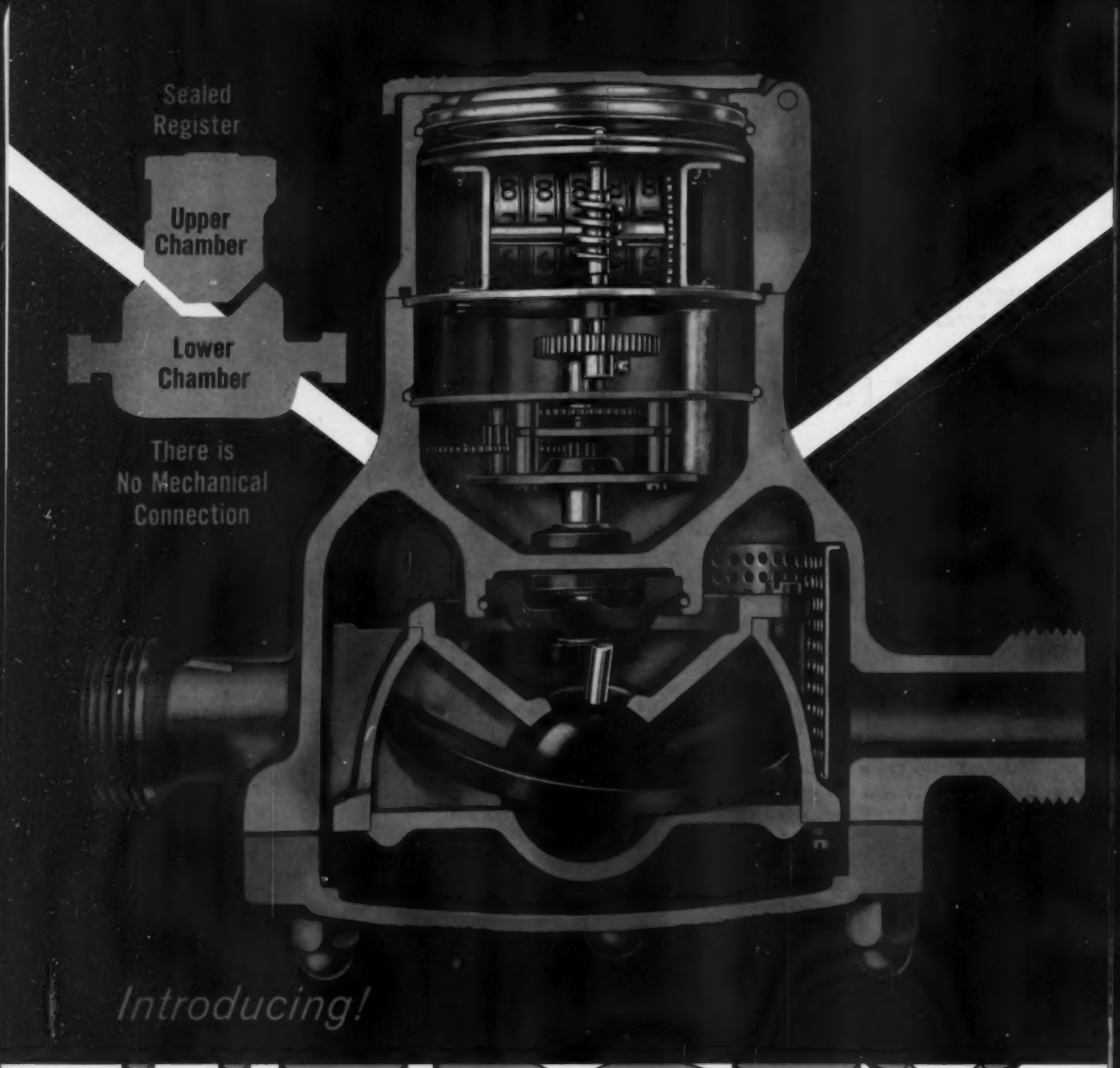




Side Dump Buckets



Rotary Snow Plow



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- No Stuffing Box
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ON ROAD
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GET A 'Jeep'® FLEET!

If there's a job to be done, there's a 'Jeep' vehicle to do it. A tremendous array of 'Jeep' approved special equipment handles thousands of specialized jobs. Traditional 'Jeep' ruggedness keeps 'Jeep' vehicles on the job years longer in any kind of weather, in any kind of "going" ☐ A 'Jeep' fleet is a sound business investment. Initial cost is low. Maintenance costs are low. And resale value is amazingly high. In fact, a two year old 'Jeep' Universal sells for up to 90% of original list price ☐ Find out about the 'Jeep' vehicles that are specifically designed to meet your needs. Write to R. J. Kreusser, Fleet Sales Manager, Willys Motors, Inc., Toledo 1, Ohio.

'JEEP' FLEETS—FROM THE WORLD'S LARGEST LINE OF 4-WHEEL DRIVE VEHICLES

Willys Motors, Inc., Toledo 1, Ohio. One of the growing Kaiser Industries.

This mark tells you a product is made of modern, dependable Steel.

Spring Scene...

with a hidden message for those who design, build and maintain busy streets

There's more to this picture of Washington, D.C. in early April than meets the eye. It's what you *don't* see that makes this scene so significant.

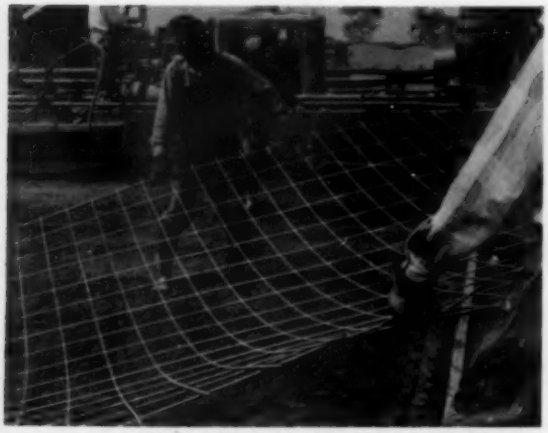
Paved streets in Washington is what this message is all about. Its purpose is to show you how *good* city streets or county roads can look after a hard winter . . . *before* the repair crews have gotten around. The reason you don't see gaping cracks, potholes and other types of roadway damage usually found after a long, hard winter is because over 600 miles of portland cement concrete street pavements in Washington (serving either as a concrete base for asphalt topping or conventional surface pavement) have been specified and built with welded wire fabric steel reinforcement.

Steel reinforced concrete pavements perform efficiently under constant stop-and-go rush hour conditions as well as under the hi-speed pounding of heavy thruway traffic. They last longer. They cost less to maintain because they have far fewer joints and all cracks are held tightly together.

Welded Wire Fabric adds 30% more strength to concrete pavement slabs. This is achieved because the steel reinforcement distributes the load transfer and reduces stresses in the slab by about 30%, thus diminishing the pavement's tendency to develop cracks, and prevents the progressive opening of any cracks which do occur. Reinforced pavements provide a safe, smooth riding surface that lasts.

Today USS American Welded Wire Fabric is stronger than ever. Minimum tensile strength is now 75,000 psi. Minimum yield strength is 60,000 psi. A 100% machine-fabricated product—ready for immediate placement—it is available in weights, gauges and dimensions to your exact specifications. For more information, contact our nearest Sales Office, or write direct to American Steel and Wire, Room 1275, Rockefeller Building, Cleveland 13, Ohio.

USS and American are registered trademarks



Workers place sheet of 50-lb. welded wire fabric on a freshly poured concrete base which will later be topped with asphalt.

American Steel and Wire Division of United States Steel

USS

TAKING THE IRON OUT OF WATER

Here's how 4 water plants do it with a minimum of manpower

Dissolved iron (Fe) as high as 10 ppm or more can be decreased to acceptable minimums by Permutit Pressure Filters. Of course, it is necessary to first oxidize the dissolved iron by either aeration or chemical treatment to precipitate it from solution.

With Permutit Pressure Filters, iron reduction as well as color and turbidity removal is accomplished at satisfyingly low cost, both initial and operating. All of the filters shown here are equipped with Permutit's labor-saving Multiport valve which does the work of five separate valves and has but three settings — "backwash", "rinse" and "service". Fully automatic, as well as manual, Multiport Valve controls are available for Permutit Pressure Filters to provide the ultimate in time saving and efficiency.

If you would like to know more about iron removal, or filtration in general, with Permutit Pressure Filters, we will be glad to send you a copy of our Bulletin 2225-C on the subject. Write to: Permutit Division, Pfaudler Permutit Inc., Dept. PW-91, 50 W. 44th St., New York 36, N. Y. In Canada, contact the Permutit Company of Canada, Toronto.

PFAUDLER PERMUTIT INC.

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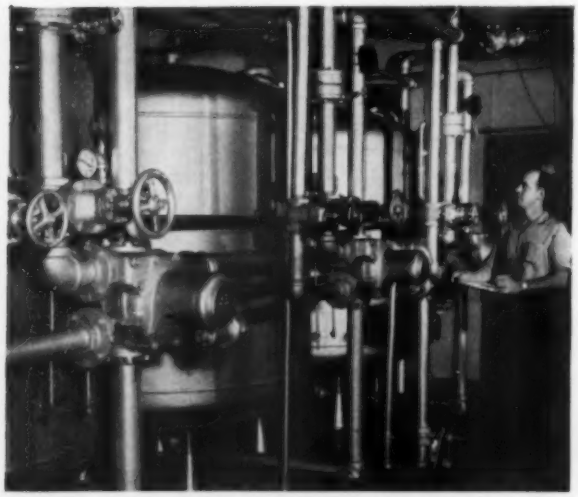
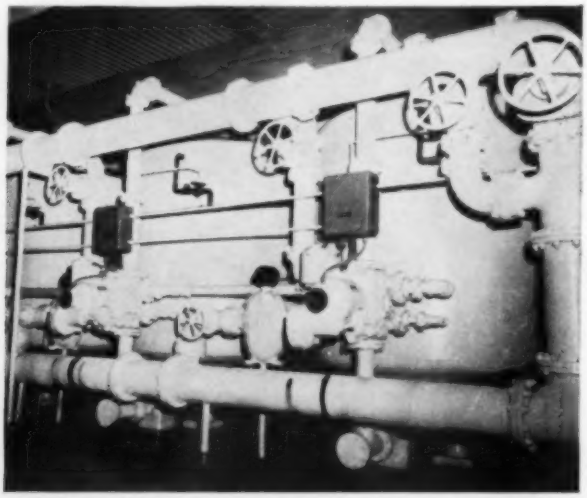
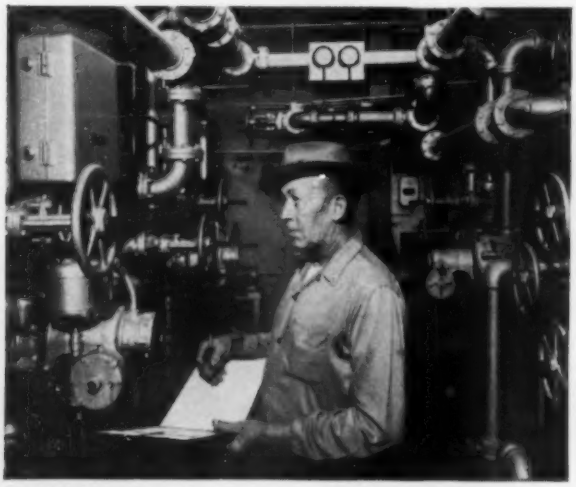


Sebree, Kentucky: V. A. Craig, Filter Plant Operator, checks these Permutit Pressure Filters which reduce iron content of city water from 2.5 ppm to 0.1 ppm, and color from 10 to 3. Mayor James Horner reports, "We are pleased with operation; water is much more satisfactory."



Rushville, Indiana: Here, water from various wells passes through automatically controlled Permutit Pressure Filters and softeners. Iron varies from 4.0 to 10.0 ppm; manganese from 0.00 to 0.3. Both are removed effectively.



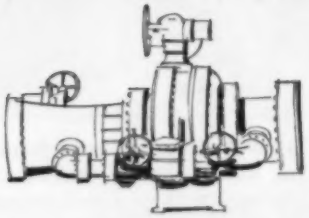
Carmel, Indiana: Permutit Pressure Filter and automatic softener equipment here being inspected by Curtis J. Collins, city water superintendent, reduces iron from 1.3 ppm to 0.15 ppm, color from a rating of 35 to between 5 and 10.

Birmingham, Michigan: This high school's water treatment includes (left) Permutit softeners and (right) Permutit Pressure Filters. Three 54" iron removal filters are seen here, each with manually controlled Multiport Valve.

For East Bay Municipal Utility District...

PELTON

Spherical Valves

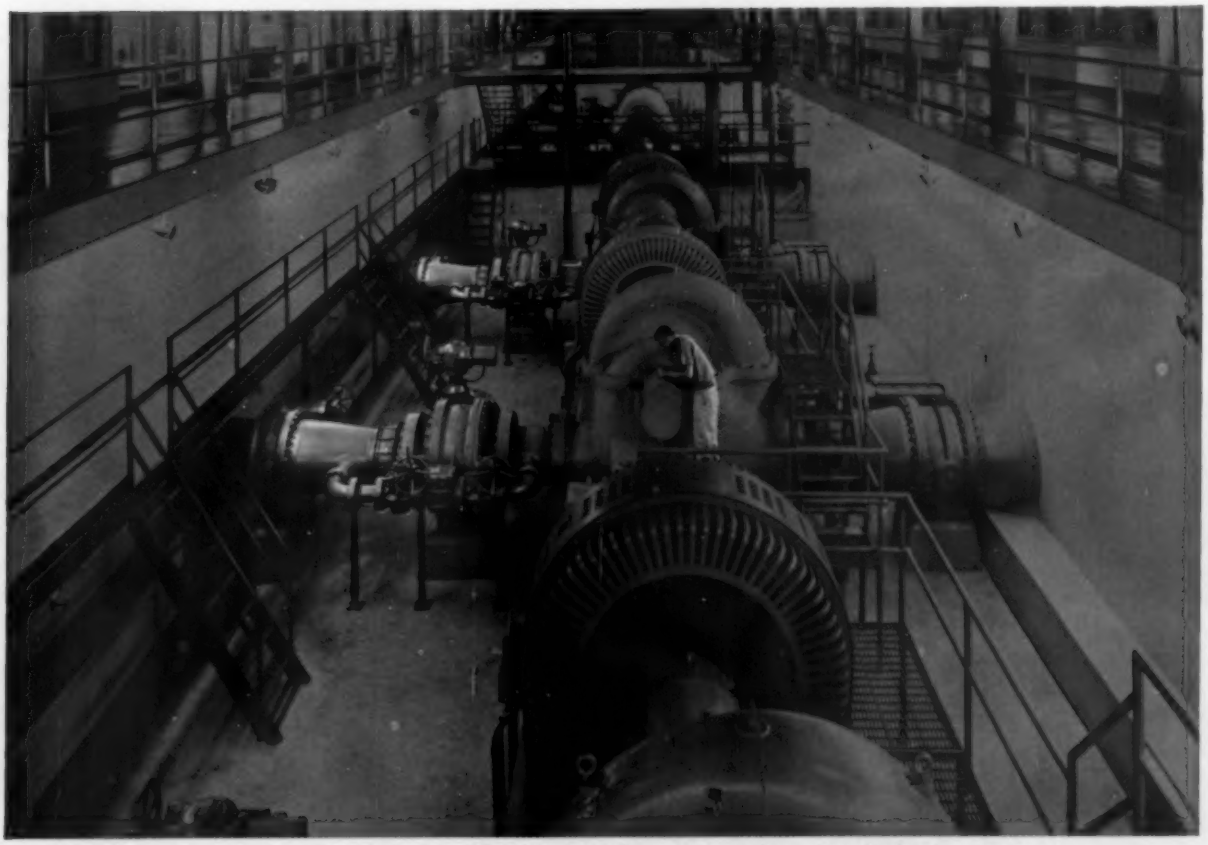


Six 24-in. Pelton spherical valves are now doing pump-check duty in the new Walnut Creek Pumping Plant of the East Bay Municipal Utility District in Oakland, Calif. All are electric motor operated. Pelton spherical valves are also available with hydraulic or manual operating mechanisms.

Among the noteworthy features of Pelton spherical valves:

- Positive throttling control, which permits optimum pump startup and shutdown
- Valve shaft located eccentrically to the operating axis of the valve, which tends to lift seat from body seal ring and thus reduce seal wear
- Positive valve seating with wear compensated for by ball positioning

Pelton builds spherical valves in sizes ranging from 6 to 60 in. and for all waterworks operating pressures. If you would like detailed information on Pelton spherical valves, write Pelton Division (B-L-H), 2929 Nineteenth St., San Francisco 10, Calif.



Booster Station of East Bay's Walnut Creek Pumping Plant, with six Pelton spherical valves in operation

BALDWIN · LIMA · HAMILTON

Pelton Division · San Francisco, Calif.

Hydraulic turbines • Valves • Governors • Centrifugal pumps

TO START THE DAY, Mayor Michael J. Nervine of Bernardsville checks over the list of work assignments with Trojan operator Leroy Pierson.

SUMMER — Scarifier teeth permanently mounted at rear of bucket rip old asphalt pavement to begin work on a road reconstruction project.

In The Borough

SPRING — Trojan's 13'3" overall height makes trimming of overhanging limbs and branches along streets a fast and easy chore for the park department personnel.

FALL — The 8,000 lb. lifting capacity of the model 134, low load carrying position and 40° tip-back bucket facilitates truck loading of dead trees and heavy debris.

ALL YEAR — Trojan's long reach and high dumping clearance makes truck loading fast and easy... Operators can move in and out without damage to truck sides.

WINTER — Snow plow equipped Trojan keeps traffic moving in spite of heavy drifts. Quick change to bucket permits truck loading snow in crowded downtown areas.

# of Bernardsville...

a Trojan model 134 tractor shovel has completed its first 4-season cycle to the complete satisfaction of officials charged with maintenance of 42.64 miles of streets . . . In winter, utilizing 4-wheel drive and plow equipped, it quickly opened streets to traffic — then, changing to a 1-1/3 yd. bucket, truck loaded snow in downtown business sections and parking areas . . . During spring and summer it ripped old pavement with scarifier teeth permanently mounted at rear of bucket; graded bituminous material on street repair jobs; handled shoulder maintenance and truck loading of gravel, stone and fill. The park department utilized Trojan's raised bucket height of over 13′ to cut and trim trees . . . Fall found it cleaning up leaf and trash accumulations and loading heavy debris for disposal.

. . . Mayor Michael Nervine of this growing New Jersey community states . . . "Our Trojan's high over-the-road speed lets us fully utilize its many job applications. It is powerful, low in operating cost, safe and easy to operate. We like the protection to our operators afforded by the reverse curve lift arms . . . In these days of rising taxes we have cut costs in our public works department through effective all-year use of our dependable Trojan tractor shovel."

. . . There is a Trojan tractor shovel designed especially for municipal work and municipal budgets. Dependable performance plus a variety of quickly interchangeable attachments make it the machine your town can keep hard at work every day of the year.

AD NO. 44-46

TROJAN®
TRACTOR SHOVELS
YALE & TOWNE

THE YALE & TOWNE MANUFACTURING COMPANY
TROJAN DIVISION • BATAVIA, NEW YORK

Visit our Exhibit at the 1961 APWA Congress and Equipment Show in Minneapolis!

So durable it outlives the project . . .

Galvanized Beth-Cu-Loy Drainage Pipe

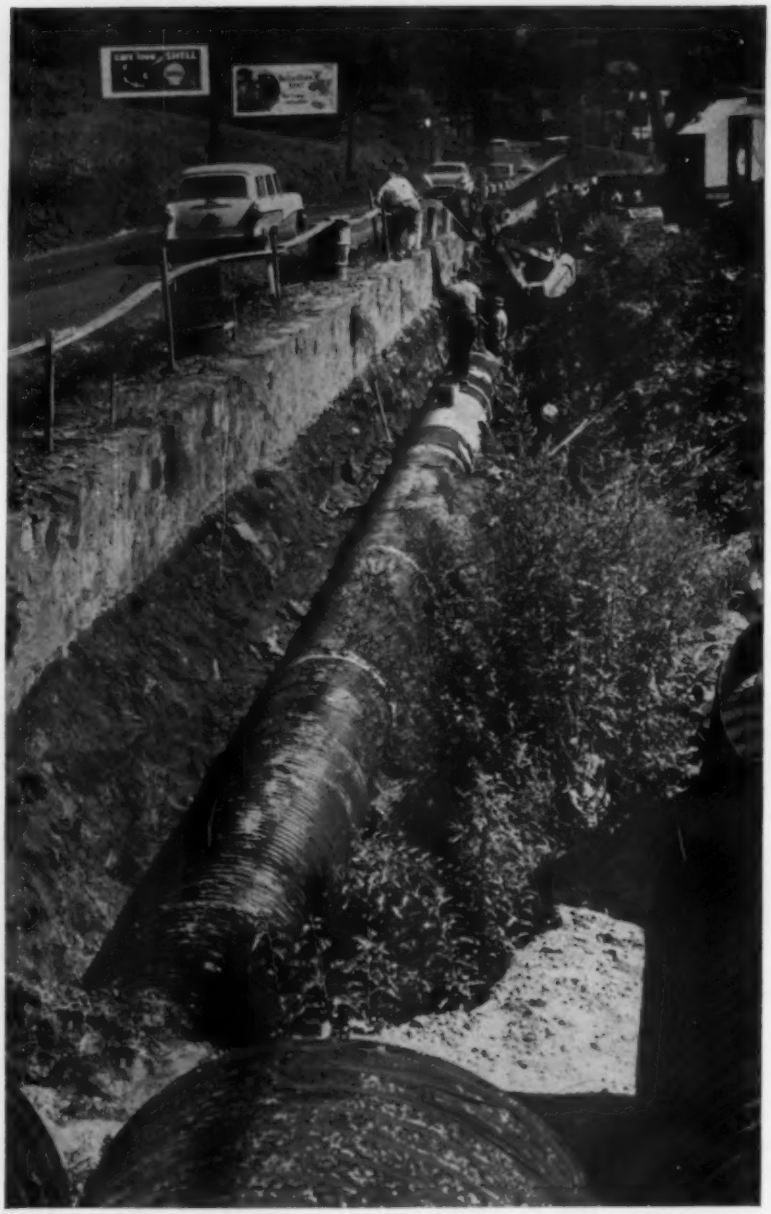
For over 50 years thousands of corrugated metal pipe installations have been studied. These studies show clearly that drainage structures made of galvanized corrugated Beth-Cu-Loy steel sheets are as durable as you could want. That's one reason why you can figure that Beth-Cu-Loy pipe will probably outlive the original drainage need.

A Beth-Cu-Loy drainage structure gets its durability from two sources. First, the strong copper-bearing steel sheet itself; second, the tightly-adherent corrosion-resisting zinc coating (2 oz per sq ft by triple spot test). These two ingredients combine to give you a pipe that is strong, long-lasting, light in weight, flexible.

And flexibility is important, too. It is the flexibility of a Beth-Cu-Loy pipe that transfers some of the imposed load to the surrounding material. Many states actually specify the use of corrugated steel pipe under fills of less than 2 ft or more than 15 ft. The product lends itself to the pipe-arch design where low headroom is a factor.

A Beth-Cu-Loy pipe is easy to handle and install; requires a minimum of engineering. Field joints can be made in minutes without delays for setting or curing. The Beth-Cu-Loy sheets conform in all respects to the specs of the AASHO. Ask your fabricator for full details about drainage structures made from corrugated galvanized Beth-Cu-Loy.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.
Export Distributor: Bethlehem Steel Export Corporation



Tar-enameled Beth-Cu-Loy corrugated steel pipe being installed as storm sewer along eastern Pennsylvania road. The pipe should easily outlast this drainage need.

for strength
. . . economy
. . . versatility

BETHLEHEM STEEL

4 new permanent colors in GPX plywood

- GPX is now available with acrylic overlay ... in permanent colors of green, white, blue or red. Order it in any combination of colors front and back, or with natural or black high density one side.
- Resists severe weather and abuse. Won't rust or corrode. Can be fabricated with woodworking tools. GPX costs less, lasts longer than metal. Reflective sheeting bonds better to overlaid plywood surface.
- Strong, stiff panels light, easy to handle. Require minimum backing and framing.
- 1-piece panels up to 60" x 120", larger scarfed panels also available.
- Write today for free sample, complete data.

GP
GEORGIA-PACIFIC

Dept. PW-961-MD, Equitable Building, Portland, Oregon • plywood • lumber • redwood • hardwood • pulp • paper • chemicals

Ed Cleary comments:

What's In a Name? Let's Examine the Term "Industrial Wastes"

EDWARD J. CLEARY

Diplomate, American Academy of Sanitary Engineering
Cincinnati, Ohio

"Sticks and stones will break my bones
But names will never hurt me"

CHILDREN HAVE found solace in chanting this refrain. But when they grow older they discover that names do create emotional responses, some of which can be traumatic. This psychological fact might command the attention of those engaged in water-pollution control practice, specifically with regard to the present suitability of the term industrial wastes.

The connotation attached to "wastes" is completely negative. It conveys the meaning of liability—something useless in addition to being undesirable. But are these accurate and proper attributes? And does not the name itself discourage a display of resourcefulness in dealing with industrial effluent problems?

In pondering these questions the writer recalls a pollution-control conference several years ago addressed by a score of engineers and one professor of agronomy. After listening to the engineers (all of whom represented manufacturers and regulatory agencies) refer interminably to the subject of industrial wastes, the professor said: "No farmer worthy of the name would regard any by-product of agricultural effort as waste. These materials are looked upon as residues, each of which has some usefulness or, at least, has the potential of being made useful".

The agronomist made an important point in these remarks. He revealed a basic difference in attitude that was reflected in the choice of a name. Further evidence of the influence of positive thinking with regard to alleged waste products is displayed in titling of the division in the U. S. Department of Agriculture concerned with such matters—it is named the "Agricultural Residues Division".

All of this leads to the conclusion that there may be merit in seeking to emphasize a *residue*-conscious attitude toward industrial effluents as opposed to the *waste*-oriented viewpoint that has so long prevailed. An obvious first step in this direction would be to use the term industrial residues.

Residue-Conscious Examples

The fact is we already have some happy examples of what can be accomplished when management becomes residue-conscious in dealing with its so-called industrial-waste problems.

A notable case is that related to the distillery industry. Here the recovery of fermented, spent grains and solubles virtually eliminated a former stream pollution problem. And the sale of cattle feed produced from the recovered materials is reported, in

A message from Joseph F. Heil
President, The Heil Co.

Lowest bid doesn't always mean lowest cost!

IF THE overall cost of collecting and hauling garbage or trash is important to you, then I hope this message will be helpful.

The Heil Co. makes a new type of refuse collection truck body — has been making it for almost one year. We call it the Heil MARK II COLECTOMATIC®. It is a radically improved version of the COLECTOMATIC we previously made for a period of seven years.

This new MARK II model can be important to you because it can materially reduce your cost of picking up refuse and hauling it to the dump or incinerator. I don't mean it will cost less to use than open truck bodies or other obsolete types of equipment, although of course it will. But the MARK II will collect and haul refuse for less in overall cost than any other current model of equipment against which we bid in competition every day.

Now, the delivered bid price of our MARK II COLECTOMATIC is not always the lowest-priced unit offered — on the basis of delivered price per unit. However, it *is* the lowest-cost unit for you to buy and operate, if you will rate the equipment offered you according to how it will perform for you on your collection routes.

A truck collection unit that will cover 20% more collection pick-ups per week will offer lower-cost service even though its first cost might be slightly higher than other truck body models. For example, if a typical current competitive unit will handle 1,000 pick-ups per 40-hour week, it would cost 28.4¢ per pick-up (assuming a $7.10 cost per hour to cover driver, helpers, maintenance, fuel, garage, and depreciation).

If the MARK II's *Duo-Press* packing ability and fast loading action will handle 1,200 pick-ups in the same period, your cost will go down to 24.5¢ per pick-up — a saving of 3.9¢ per collection—about $2,000 per truck unit *per year!*

These results are only typical of what the MARK II COLECTOMATIC is doing in many cities every week.

I am not asking you to be convinced that our COLECTOMATIC will outperform all others on your routes, just because I make that claim. I *am* asking you to let us prove it by actual demonstration. And I am asking you to buy equipment to give the lowest overall cost of collection, year after year, rather than to buy on cubic yards of rated capacity and lowest bid price alone.

We are proud of the quality, design and manufacturing standards exemplified in our MARK II COLECTOMATIC. We hope you will let us prove it is the best equipment for your routes.

Joseph F. Heil.

THE HEIL CO.
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Cleveland, Ohio • Modesto, Calif.

some cases, to spell the difference today between profit and loss in operating a distillery.

Another example relates to the steel company that was under orders to abate the disposal of flue-dust discharge that had been clogging miles of stream bed. A half-million dollar expenditure was made in constructing settling basins to accomplish the clean-up. But the entire investment was returned in one year by the recovery of iron.

Another company that discharged several thousand gallons of waste oil a week in its effluent now skims off the oil for burning under its boilers. With the accounting department putting a value of one cent a gallon on this oil the company no longer regards it as a waste material.

Then there is the case of the methanol producer whose discharge of spent grain into a river finally occasioned a cease-order from the state regulatory agency. In its search for a "waste" disposal method, the company chemists discovered that the material was abundant in vitamin B-12. This led to a unique solution—vitamin extraction is now the principal product; methanol is a by-product and the river has been relieved of a pollution burden.

The metal-finishing industry has had good reason to become residue-conscious with regard to its effluents. It is reported, for example, that one plant has recovered as much as 1,500 tons of copper a year from its waste-water discharges. This much copper would make 46 million pennies—which hardly may be regarded as small change!

Recovery of fibers that heretofore escaped with wash waters has long distinguished the efforts of the paper and pulp industry in its continuing search for greater yields and the curtailment of stream pollution. And by-products recovered from sulfite wastes are now finding application in the manufacture of wall-board, dyestuffs, ceramics, refractory brick and linoleum cement.

And then we have the example of oil producers in the East Texas fields who formed a company to handle disposal of highly pollutional brine waters. This waste-water is pumped back underground where it originated. In so doing the oil field is being re-pressured and this in turn has increased yields from existing wells.

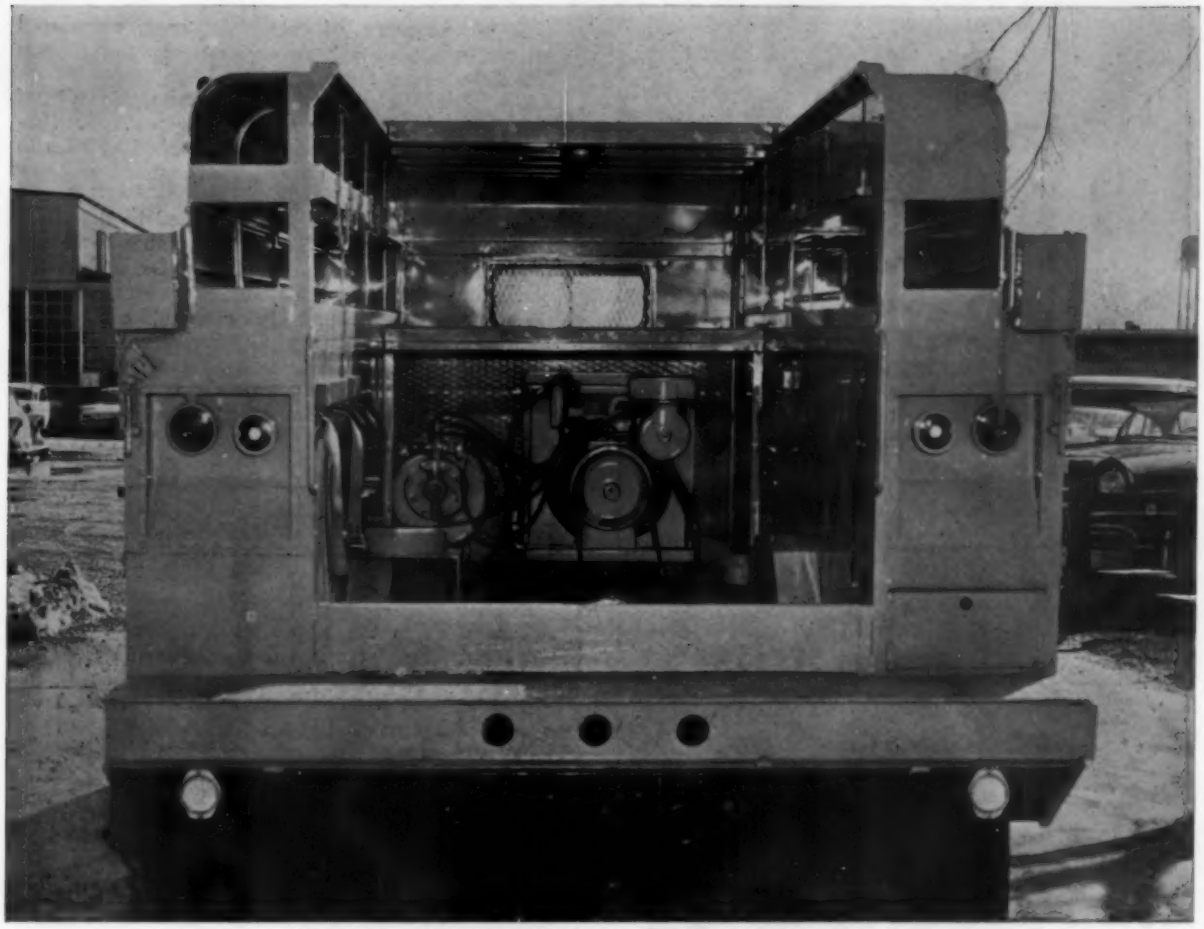
Gourmets might be offended to learn that one of their highly-prized food seasonings had its origin in what the sanitary engineer calls an industrial waste. But the fact is that mono-sodium-glutamate (marketed under various trade-marked names, including "Accent") is found in the effluent of beet-sugar processing plants.

Assets, Not Liabilities

By no means do these examples complete the catalog of "industrial wastes" that have been found salvable and put to uses other than the degradation of streams. The list does suggest that the word wastes can be a misnomer.

It is of interest to recall that a quarter-century ago the late Floyd W. Mohlman, chief chemist of the Sanitary District of Chicago, and an international authority on industrial problems, had this to say:

"Wanton waste is abhorrent to an enlightened civilization. If we have the ability to solve the intricate problems of production in improvement of industrial products, we should also have the ability to solve the problem of satisfactory disposal of waste produced by such processes. . . . There are a few outstanding examples of industries which have prof-



125-cfm power-take-off Gyro-Flo mounted behind cab of a utility truck.

Why you save truck space and cut costs when you

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power-take-off compressors

85-cfm power-take-off Gyro-Flo takes only 21½" by 24" of floor space.

Your truck engine supplies the mechanical power...the Gyro-Flo converts it to Air Power. The super-compact design of the Gyro-Flo power-take-off compressors leaves more truck space for other equipment. But there's no compromise with Gyro-Flo's traditional quality and performance-proved *dependability*.

These new units, in 85 and 125-cfm sizes, are the result of 10 years of experience by the pioneer builder of portable rotary air compressors. With Gyro-Flo, you get smooth, dependable 100-psi air power—month after month, year after year, with practically no attention or maintenance. See your Gyro-Flo distributor or send for Bulletin 2938.

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The World's Most Comprehensive Compressor Experience

ited by recovery of materials, once considered wastes, which now have commercial value. These few industries should be an incentive to the others, which still discharge *residues* (italics added) of manufactured products to the sewers. . . . (Industrial) wastes are almost universally liabilities to the sewer authority, but they may not be liabilities to the manufacturer."

Since 1938 when this was published in the *Sewage Works Journal* an increasing number of industries have discovered the validity of Dr. Mohlman's observation. But we still retain—as revealed by terminology—the negatively oriented concept of industrial effluents as "wastes" instead of "residues", as liabilities instead of potential assets.

Perhaps it takes more than a change in a terminology to promote a change in viewpoint—but it could help. □□□

Engineering Notes

Changes in Construction Costs

Comments in the 1960 annual report of the Elmira (N. Y.) Water Board underline the need for realistically increased water rate structures by comparing current costs with those in effect when the system was purchased in 1915.

"At the present time the Water Board has in service over 31,000 ft. of small mains—2 in. and under, originally installed as wrought iron or steel, and 3,630 services, all over forty years old. These mains and services are approaching the limit of their normal life and will have to be replaced during the next ten year period. The cost of making these replacements continues to increase for two reasons—one the increased cost of labor and materials and the second, the more rigid specifications for doing the work. As an example, the requirement that all material removed from a service renewal excavation in the street area has to be discarded and hauled away, and then replaced with run of bank gravel properly consolidated, has caused a substantial increase in the cost of service renewals. We find that old services being retired had an original cost average of $11.18 each—as compared with the present replacement cost average of $81.07 each. The same situation is true in regard to mains, where the original average cost of a retired main was $1.58 per foot and is now about $9.98 per foot. Meters that are retired originally cost about $9.00 each, as compared with the replacement cost of $33.80 each.

"As an indication of the change that has taken place in this cost structure, in 1915 the minimum water bill of $3.51 per quarter provided an annual revenue of $14.04, which was enough to install 16 feet of 6-in. main. In 1961 our current minimum bill of $3.78 per quarter provides a $15.12 revenue per year and is sufficient to install only 2½ feet of 6-in. main. The price of the material alone required for main installations is exemplified by the price of 6-in. pipe, which has risen from $.48 per foot in 1915 to $1.65 per foot in 1950, and with a further increase to $2.82 per foot in 1960. Other components of water plant construction have risen in a similar proportion.

"The rise in material cost, together with the increase in labor costs over the years, have served to increase the investment required per service

connection from the figure of $170 when the plant was purchased in 1915, to the present figure of $330 per service connection. This investment will continue to rise as we proceed with the necessary replacements of low cost 1915 units of property with the higher unit costs of today."

Corrosion of Steel Piles in Salt Water

A study of the corrosion of steel piles in salt water was reported on by James R. Ayers and Ralph C. Stokes, consultants to the Navy Bureau of Yards and Docks in a paper at the Boston meeting of the ASCE. The paper has been published in The Navy Civil Engineer. The conclusions from this careful and complete study are reported as follows:

1. The corrosion rate of steel piling based on all available information is summarized as follows: (a) The maximum average rate occurs above and/or within the tide zone. (b) A secondary maximum average rate of lesser magnitude occurs in the anodic area about two feet below MLW. (c) The average rate at half depth is comparatively low. (d) The average rate in the vicinity of the mud line is generally quite low. (e) High rates do not generally occur on the landward side of sheet piling except in the case of porous backfills with water filtering down behind the piling. High rates are experienced on the landward side when coral fills are used in tropical climates.

2. A properly maintained cathodic protection system reduces the rate of corrosion below the mid-tide level.

3. A protective coating over the full length of a pile reduces the corrosion rate as long as the coating remains. Deterioration of the coating occurs first in the tide zone and progresses upward to the top, and at a slower rate below water. On most Navy installations, failures of coatings in the tide zone have occurred within the first 2 years.

4. The most complete protection system for steel piling is concrete jacketing in the tide range and cathodic protection below mid-tide.

5. Multi-alloy steel has a low corrosion rate for the upper portion of piling. It offers an alternative which may be comparable to concrete jacketing in longevity. Furthermore, the superior physical properties of multi-alloy steel will permit a much greater reduction of thickness below water without exceeding the allowable design stresses.

6. Cylindrical steel bearing piles are the most desirable shape for unprotected piling because of the smaller external area exposed to corrosion.

Water Consumption Data

The Manchester, N. H., Water Works reports that the month of highest consumption during 1960 was July, with a total of 435.7 mg; February, with 301.8 mg had the lowest consumption. Highest day was July 12, with 20.7 mg and lowest day was April 24 with 6.8 mg. The peak 7-day consumption, July 8 to 14, totalled 112.6 mg. Rainfall amounted to 41.6 ins. (65-year average 39.33 ins.) and was evenly spaced.

Truck Accident Data

The Department of Public Works of Detroit, Mich., operated an average of 743 motor trucks during the fiscal year 1959-60, driving 5,247,317 miles. There were 178 chargeable accidents or 3.39 accidents per 100,000 miles of vehicle operation.

Double the clear water capacity at half the installed cost with Celite Filtration

Because diatomite filtration systems using Celite® filter aids require one-fourth the housing space of equivalent-capacity sand systems, real estate and construction costs are drastically reduced. These savings, combined with the low initial price of a diatomite unit, permit the construction of new water filtering plants at one-half the cost.

Celite is the most efficient and economical filter aid available. It removes all suspended solids—including amoebae, floc and algae—while maintaining maximum flow rates. And, this clearer, brighter water is produced at a lower cost because a compact, semi-automatic diatomite system is easily operated and maintained by regular municipal water personnel.

For full information write: Johns-Manville, Box 14, New York 16, N. Y. In Canada: Port Credit, Ontario. Cable address: Johnmanvil.

JOHNS-MANVILLE JM PRODUCTS

MODEL SANITATION DISTRICT PROVES LOAD-PACKER BEST

Outstanding Long Island Operation Goes Gar Wood Exclusively

SANITARY DISTRICT NO. 2 PICKED LOAD-PACKERS for bigger loads, greater compaction, lower operating costs. Trucks are cleaned and waxed weekly, continually kept in top operating condition.

Sanitary District No. 2 of the town of Hempstead, Long Island, is widely known as a model of refuse collection efficiency. The district services the cities of Baldwin, Roosevelt, and South Hempstead, N. Y. It has used Gar Wood Load-Packers exclusively since 1947—a fleet of 19 units.

Superintendent Sal Sorrentino is a man who knows his business, and he has this to say about the Gar Wood Load-Packer: "It's unquestionably the best unit made. Our Load-Packers give us full-capacity loads with excellent fuel economy, and we have had practically no maintenance problems whatever."

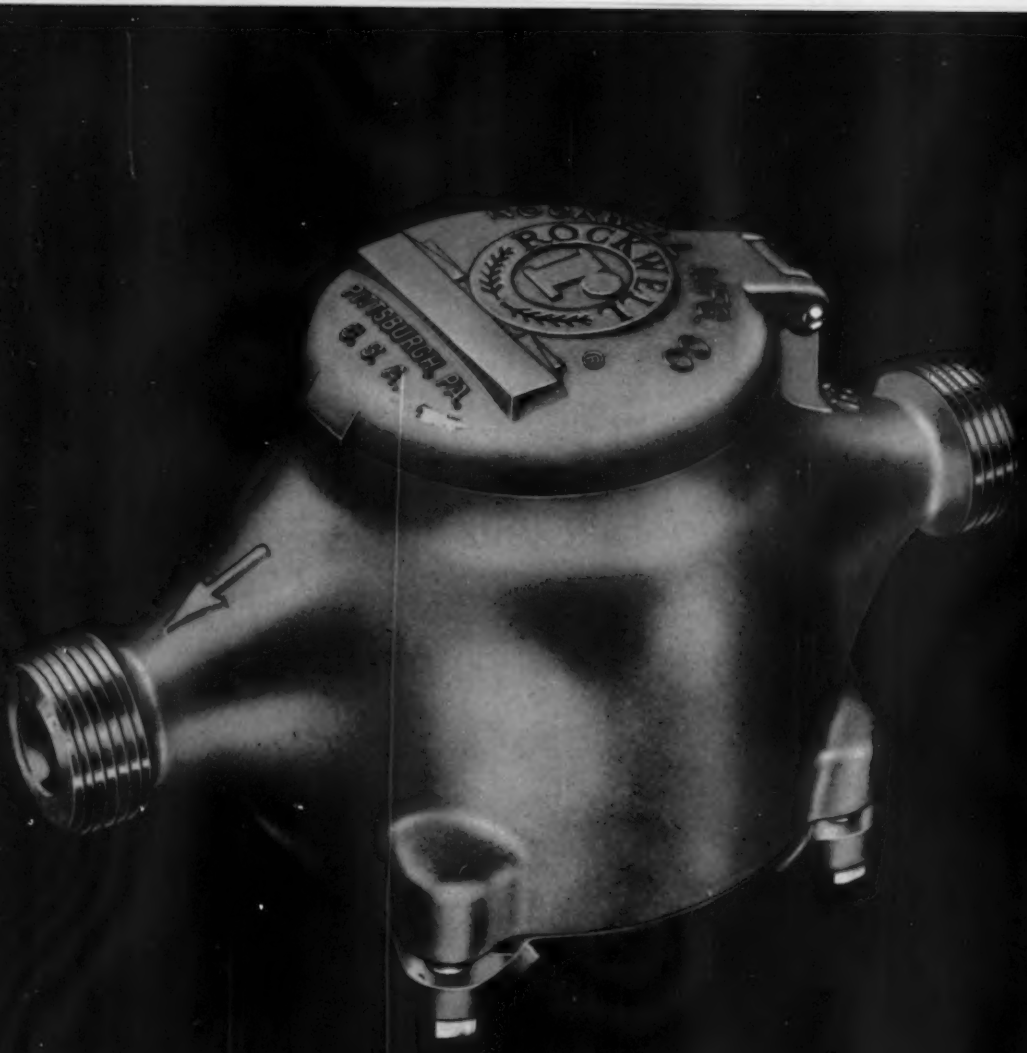
By starting with these outstanding packers, then giving them excellent care, Sorrentino has built his operation into one of the best in the country. It's a formula that can cut costs for any municipality, any private collector. Your Gar Wood-St. Paul distributor will be happy to prove it to you.

LOAD-PACKER 600 IS SUPERIOR FOR SIX IMPORTANT REASONS

There are six big reasons why the Load-Packer 600 carries larger loads at less cost per load:

1. **FASTEST OPERATION**—Crew starts reloading in just 4 seconds... full cycle takes only 10 seconds.
2. **GREATEST COMPACTION**—Direct thrust compaction packs more per yard than any competitive unit.
3. **BIGGEST LEGAL PAYLOADS**—Biggest loads on any given chassis for two reasons. First, dead weight is cut to a minimum; second, telescopic hoist eliminates heavy sub-frames and improves weight distribution.
4. **SAFEST, MOST DEPENDABLE**—Controls are simple, foolproof. Operator has positive control. Fewer moving parts, less linkage, few adjustments.
5. **GREATEST ECONOMY**—Biggest hopper and fastest packing cycle cut fuel costs and equipment wear.
6. **LARGEST, LOWEST HOPPER**—Big 1½ yard, 74-inch-wide hopper, plus low loading height speeds collection, makes crew's job easier, means fewer packing cycles.

GAR WOOD INDUSTRIES, INC. Wayne, Michigan Richmond, California



ROCKWELL SEALED REGISTER* METERS

Imitated, but never equalled

The Rockwell Sealed Register* "Magnetic" meter is *not* an adaption of any previous design.

Starting from scratch, Rockwell engineers could and did develop an all-new meter—one that did not compromise any desirable feature.

For instance, they materially *reduced* the number of working parts *instead of adding more.* They made this meter tamper-proof. Greater accuracy was engineered into the design.

From a maintenance standpoint, the Rockwell Sealed Register* meter is by far the *easiest* and *most economical to repair.*

Let our representative prove these facts to you or write for bulletin W-811.

For prompt shipment from warehouse stocks contact Rockwell Manufacturing Company, Department 162J, Pittsburgh 8, Pennsylvania. In Canada: Rockwell Manufacturing Company of Canada, Ltd., Box 420, Guelph, Ontario.

**Trade mark*

SEALED REGISTER* METERS

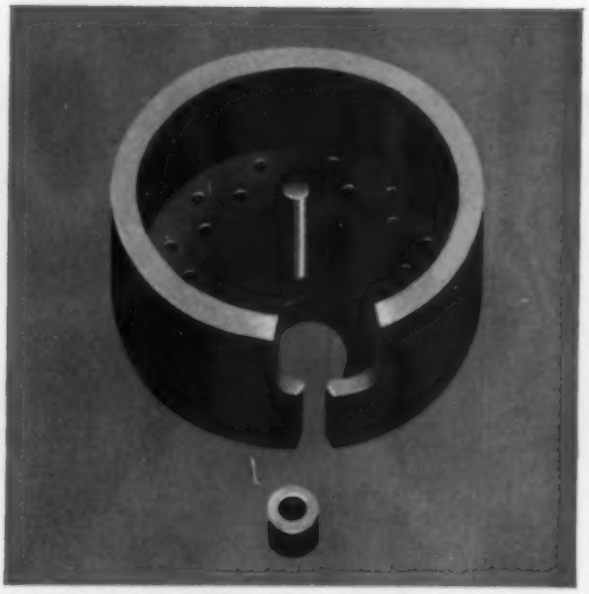
another fine product by

ROCKWELL

4 good reasons why you're dollars ahead using the only completely new "magnetic" meter

STRAIGHT LINE MAGNETIC DRIVE

A simple, powerful magnetic coupling transmits every motion of the measuring chamber directly to the sealed register in a vertical line. The permanent Alnico magnets are completely sealed. Their strength will not deteriorate with time.



ONLY TWO REPAIR PARTS NEEDED

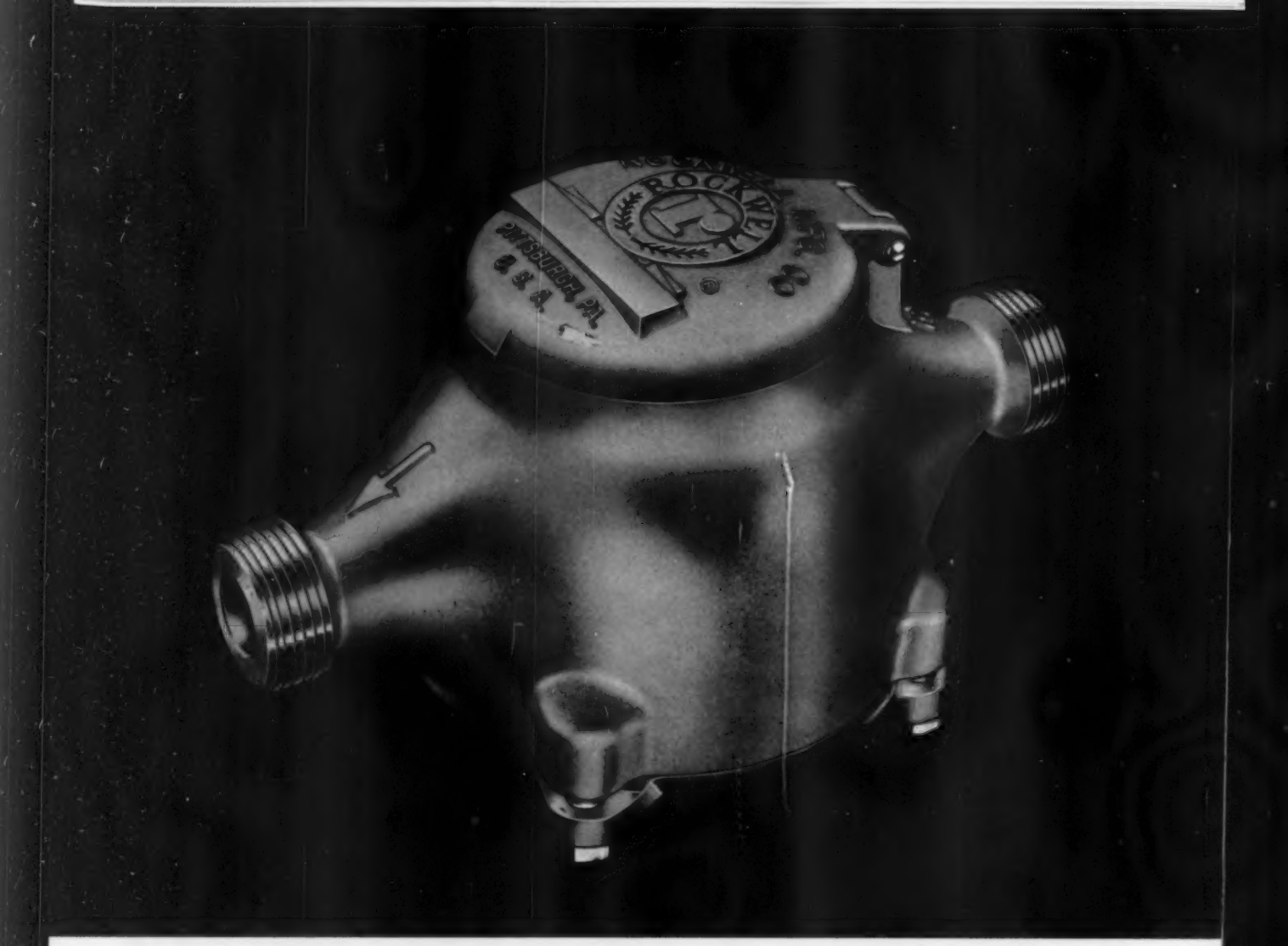
The piston and piston roller are the only parts operating in water. These two parts are all you need to carry in inventory as compared to the large number required to repair other meters. Using only a wrench, anyone can replace these parts fast.

COMPLETELY TAMPER-PROOF

The sealed register is recessed into the main casing. Even if dismantled, the meter won't work without the register and the register won't turn without the meter. With this meter you'll stop tampering—stop losing important revenue.

COST NO MORE, EARN MORE, SAVE MORE

These better "magnetic" meters cost you no more to buy and cost you much less to maintain than other types of more complicated design. Since they have the fewest parts to wear they are easiest and most economical to repair.



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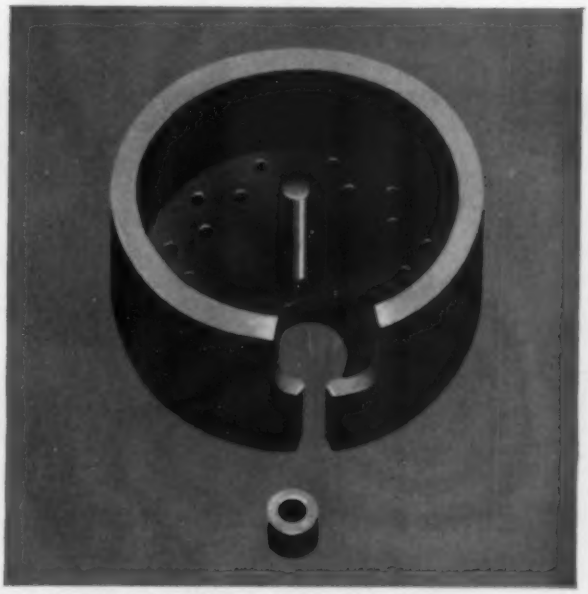

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These better "magnetic" meters cost you no more to buy and cost you much less to maintain than other types of more complicated design. Since they have the fewest parts to wear they are easiest and most economical to repair.

It moves

... powered and controlled by Westinghouse

Press a button—an indoor auditorium becomes an open air stadium in 2½ minutes—and behind that button is an unparalleled story of engineering and construction cooperation.

Architectural and engineering teamwork has given Pittsburgh the world's first movable roof auditorium. This versatile structure adds to the city's renaissance, in one building, a 14,000 seat sports arena, a convention hall, open air amphitheater, and an exhibit center. Westinghouse products bring the facilities to life, give precision control for the delicate manipulation of six 300-ton movable leaves.

Outwardly, the new auditorium is a 400′ stainless steel

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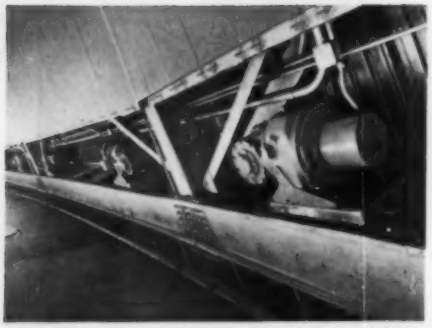
umbrella, suspended from a space frame cantilevered from the ground. That is one outstanding construction teamwork story.

Inside, coordination culminates in a control console located high above the seating area. From this station the

J-94176-2

Construction Motivators: The Authority & Industry
l to r seated: Judge A. L. Wolk, Vice Chmn.; N. Stabile, Sec'ry Treas.; W. B. McFall, Chairman; H. R. Edelman, Jr., Pres. Heyl & Patterson; and D. J. McDonald, Vice Chmn.
standing: C. B. Jansen, Member; J. E. Payne, V. P. Westinghouse; and Edw. Fraher, Exec. Director



The six movable roof leaves are driven by Westinghouse right angle gearmotors, five to each leaf. Photo shows base of one of the movable leaves with the acoustic ceiling panels removed.

O. M. Newman, Heyl & Patterson, and Edward Cohen, Ammann & Whitney, discuss roof electrical drive with C. G. Falkenstein, Westinghouse, kneeling in front of main roof reactor control cabinet.

unique movable roof drive system is activated. An AC reactor control scheme keeps all six movable leaves in step throughout open and close cycles. Each leaf is driven by Westinghouse Moduline® gearmotors, with opposite leaves being operated in pairs.

Close cooperation among architects, engineers, owner, contractors and Westinghouse helped to provide a system flexible enough to serve varying building demands, with the high degree of electrical reliability required.

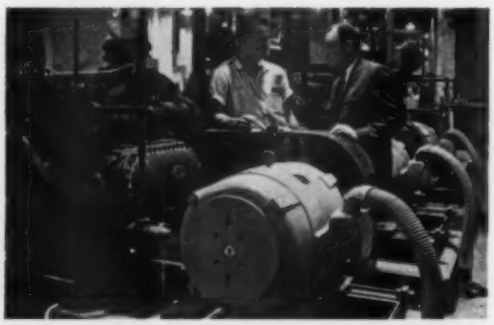
For more complete information on the electrical aspects of construction, write to: Westinghouse, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-94176-3

5KV metal-clad switchgear contains a tie-breaker to provide emergency switching between two incoming 4160-V lines. Seen here: N. J. Grady, V. P., Ernst, C. J. Long, and A. B. Janaszek.

Checking construction progress are C. J. Long and F. J. Sarknas, Westinghouse. In background, 1500 kva power center supplies power for building auxiliary and air conditioning compressor motors.

Westinghouse Motor Control Center located in the Mechanical Room centralizes auxiliary motor controls. Discussing installation advantages are H. R. Helvenston, C. J. Long and N. J. Grady.



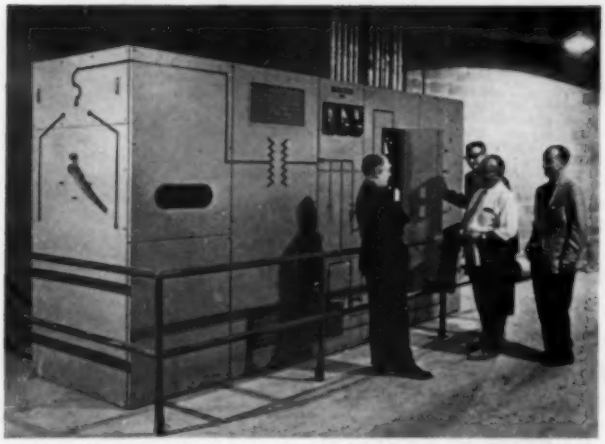
Three 125 hp Lifeline A motors drive freon compressors to chill brine supply for ice rink piping. Seen here are P. F. Schad, Limbach, and C. G. Falkenstein, Westinghouse.

Operator's view from roof control console high above the spectator area. Visible through the glass front is the juncture of the first two movable leaves of the roof.

One of main power transformers rated 2500 kva at 11.6 kv to 4160 volts. Discussing the power supply are C. J. Long, Electrical Engineer, M. A. Geffel, Ernst, and A. B. Janaszek, Westinghouse.

Builder: Public Auditorium Authority of Pittsburgh & Allegheny County: *Resident Engineer & Supt. of Construction:* H. Rey Helvenston
Architects: Mitchell & Ritchey, Pittsburgh
Roof Designers & Engineers: Ammann & Whitney, N.Y.
Electrical Engineer: Carl J. Long & Associates, Pittsburgh
Mechanical Engineer: John Mullin & Associates, Pittsburgh
General Contractor: Dick Corporation, Large, Pa.
Electrical Contractor: E. C. Ernst, Inc., Pittsburgh
Mechanical Contractor: Limbach Company, Pittsburgh
Drive System Contractor: Heyl & Patterson, Inc., Pittsburgh

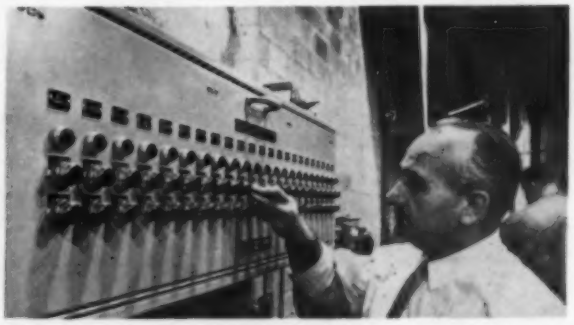
Westinghouse



Another Westinghouse power center, this 300 kva ASL dry type supplies lighting and auxiliary power. Discussing its component parts are C. J. Long, A. B. Janaszek, M. A. Geffel and Albert Simon, Ernst.

Type M Electric Stairway transports 8,000 persons /hr. Top to bottom: E. R. Gallagher, supervising architect; H. R. Helvenston, resident engineer; and A. Simmonds, Westinghouse Elevator.

Fan room equipped with series 8000 Air-Foil centrifugal fan and air conditioning coils. W. Y. Humphreys, Westinghouse, with John Mullin, Consulting Engineer, air conditioning and ventilation system designer.



Westinghouse mercury vapor parking area and floodlighting are operated from this remote control panel located in the mechanical room. M. A. Geffel, Ernst, tests lighting circuits.

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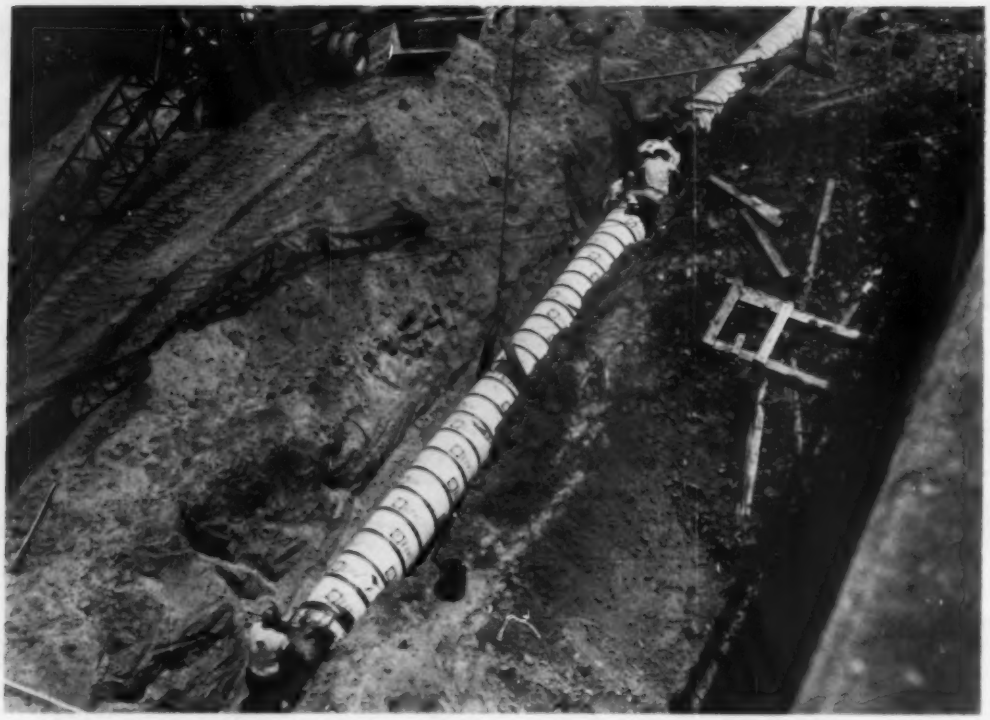
You can Rely on Armco Water Pipe

for efficiency...durability



Armco Steel Water Pipe is designed to give you reliable, efficient carrying capacity and to resist any unusual or unexpected condition. You needn't worry about washouts, soil settlements or traffic vibrations with Armco Pipe. To make certain it will withstand these conditions, each length must pass rigid strength tests before it leaves the mill. With durable Armco Pipe, reliability lasts through the years.

Steel — For strength, economy, durability

Find out how Armco Steel Water Pipe can fit *your* requirements. Mail the coupon to **Armco Drainage & Metal Products, Inc., subsidiary of Armco Steel Corporation, 7081 Curtis Street, Middletown, Ohio.**

HAVE AN ARMCO SALES ENGINEER CALL ME FOR AN APPOINTMENT.

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ADDRESS_____

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ARMCO Drainage & Metal Products

Rex Front Cleaned Bar Screens with a Pivot

Provide Maximum Flexibility for Los Angeles County Plant

In the Los Angeles County Sanitation District No. 2 Sewage Treatment Plant at Harbor City, a new concept in screening operations has assured a new high in efficiency and flexibility...a new low in operating and maintenance costs...Rex Front Cleaned Bar Screens, designed to pivot.

Close-up view showing screen suspended in channel. Note neat appearance... totally enclosed, streamlined housing and "straight-through," unobstructed flow.

Five Rex Front Cleaned Bar Screens, designed to pivot, at Los Angeles County, Harbor City Plant. Channel width, 6½ feet; channel depth, 16 feet. Two screens each handle a flow ranging from 30 to 89 m.g.d. Three screens each handle flows of 42 to 127 m.g.d.

With this advanced design, each screen is pivoted so that it can be easily swung out of the channel for inspection and servicing. No need to dewater the channel...no need to shut down operations. Screens are back in service in a hurry.

Screen pivoted out of channel. Pivot shaft rides in heavy-duty angle pillow blocks mounted on concrete pedestals.

FRONT CLEANING... front-mounted rake is held firmly in place...provides maximum shelf for carrying capacity. Positive, complete cleaning of tops and sides of bars to their full depth. Rakes *and* teeth clean the bars. No chance for rakes to slide over, or miss, screenings. Bar rack is held firmly in place at top and bottom to maintain uniform spacing.

MAXIMUM EFFICIENCY. Full 60-degree inclined racks mean greater rack area exposed to the flow. Dead plate from bar rack to point of discharge eliminates spillage...no screenings on downstream side. Chain Belt Company, 4722 W. Greenfield Ave., Milwaukee 1, Wis.

REX®

CHAIN BELT COMPANY

Brookfield, N.Y., finds Best Bid the best way to buy

"We buy machines as if we had to make a profit with them"

Mr. Lester D. Burch, Township Superintendent, Brookfield, New York: "Our community doesn't buy construction equipment very often. When we do, we need equipment that will give us the best possible performance—and do it at the lowest cost. That's why we look for *best bid* when we buy.

"No one knows more about *best bid* than a construction man who has to make money with his machines. And most contractors I know prefer to buy Caterpillar equipment. I figure what works for them will work for us.

"And it does. Take our new 93 HP D6B Tractor, for example. It has one feature alone that makes it worth a lot more to us than the other machines bid. This is the hydraulic tilt cylinder attachment. Our road work involves a lot of ditching. The tilt cylinder attachment lets the operator tilt the blade without leaving his seat. The amount of time this saves—and extra work it helps us get done—really adds up when you do a lot of ditching."

Mr. Burch mentioned another reason the town selected the D6. They needed a machine that would stay out of the shop—keep on the job. They liked the idea of the oil clutch that almost never needs attention . . . lifetime lubricated track rollers they could forget until rebuild time . . . the dry-type air cleaner that gets rid of the expense and mess of oil bath filter elements. All in all, the combination of extra performance, dependability and low-cost maintenance offered by this machine made *best bid* buying the town's best bet. Where it gives the private contractor a profit, it saves money for taxpayers.

Check the money-saving, time-saving features of Caterpillar-built machines when you need a tractor, loader, motor grader, engine or other earth-moving equipment. Your Cat Dealer can give you complete facts and a demonstration if you wish. And ask him about our new sanitary landfill movie: "A Decent Burial." He will be glad to arrange a showing.

Caterpillar Tractor Co., General Offices, Peoria, Illinois, U. S. A.

CATERPILLAR

How Detroit Solves Urban Transportation Problems

Photo by The Detroit News

GLENN C. RICHARDS
Commissioner of Public Works, City of Detroit

DETROIT, THE CORE CITY of one of the fastest growing metropolitan areas in the country, has been faced with the same difficult problems which have occurred in almost every metropolitan area. Adequate public works facilities to serve this increased population and expanding economy have been easy enough to design but hard to finance. We have gone a long way in Detroit toward finding the solution to our transportation problem as well as many of the other common urban problems.

In the early 1930's, we widened many of our main arteries at great expense and went into a broad program of one-way streets. Parking was removed during rush hours from all main arteries but the increased traffic was of such proportions as to show little improvement in the overall congestion.

By 1939 it was evident that a better method must be found for the handling of this ever-increasing traffic. Studies of various ideas convinced us that the separation of slow local traffic from fast through traffic was the answer—in other words, limited-access highways. Construction was started on the Davison Expressway in 1940 and on the Edsel Ford Expressway (formerly known as the Industrial Expressway) in 1941. Expressway construction in metropolitan Detroit has been accelerated since that time until today we are building at the rate of $40-million a year and expect to increase that rate in the near future. A cooperative study by competent city, county and state highway traffic engineers, assisted by city planners, came to the conclusion that fully depressed, multilane highways, designed with vehicular bridges an average of four blocks apart and pedestrian bridges where needed in between, was the most desirable design for our city. The design also called for sufficient on and off ramps with accelerating and decelerating lanes to allow easy and safe access.

The revenue-type bond financing, which has made possible our accelerated program, was proposed when we became dissatisfied with the progress being made on a pay-as-you-go basis. This method has had wide publicity and is the basis of our plans for financing the balance of our extensive expressway program of the future. Outstanding cooperation between the Federal, state, county and city governments must be given much of the credit for making our program possible. A comprehensive highway needs study, followed by progressive highway legislation, have also been important factors in making possible the financing of our expressways. Cooperation between the highway builders and the highway users and confidence in each other are a must if any city expects to meet the highway needs of today adequately.

Committees Formed

Since many difficult and unusual problems were certain to arise during the planning and construction period, it was determined that these matters could best be resolved by a committee-form of operation. Our city, population-wise, is a large part of the county in which we are situated and, since our state laws permit the county to participate with the city on state trunkline highway projects (both financially and otherwise), arrangements were made to include and to request the active participation of our county road commission in our program.

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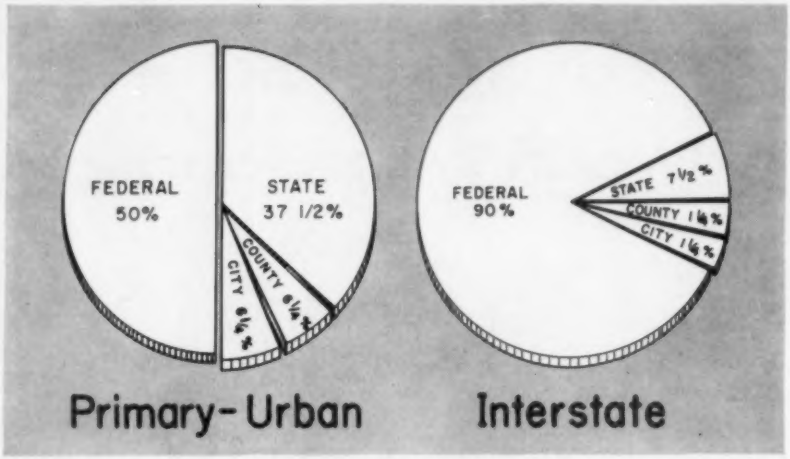
At the inception of the program, immediately after World War II, an overall agreement was entered into between the state highway department, county road commission, and City of Detroit, to construct two expressways in the city which would total about 25 miles in length. This agreement, among other things, provided that all parties would mutually plan the projects and approve all working plans prior to construction. At a subsequent date, a second stage of construction was added by including four additional routes of some 30 miles in length.

A committee was formed of engineers representing the state highway department, county, city, and, in addition, the Bureau of Public Roads since the plans would eventually be submitted to the Bureau for their approval prior to Federal participation in the projects. This committee passed upon all matters governing location, design, construction, timing and other features. A technical sub-committee, reporting to the major engineering committee, was also created to work out the various details. The sub-committee consisted of location engineers, planning engineers, traffic engineers, bridge engineers, road engineers, construction engineers, right-of-way personnel and many others that might contribute technical advice and information. Special sub-committees also were called upon from time to time to handle specific matters pertinent to construction in an urban area. These sub-committees included utility experts (both private and public), transportation experts, police and fire personnel, railroad engineers and operating personnel, land buyers, real estate advisors and attorneys.

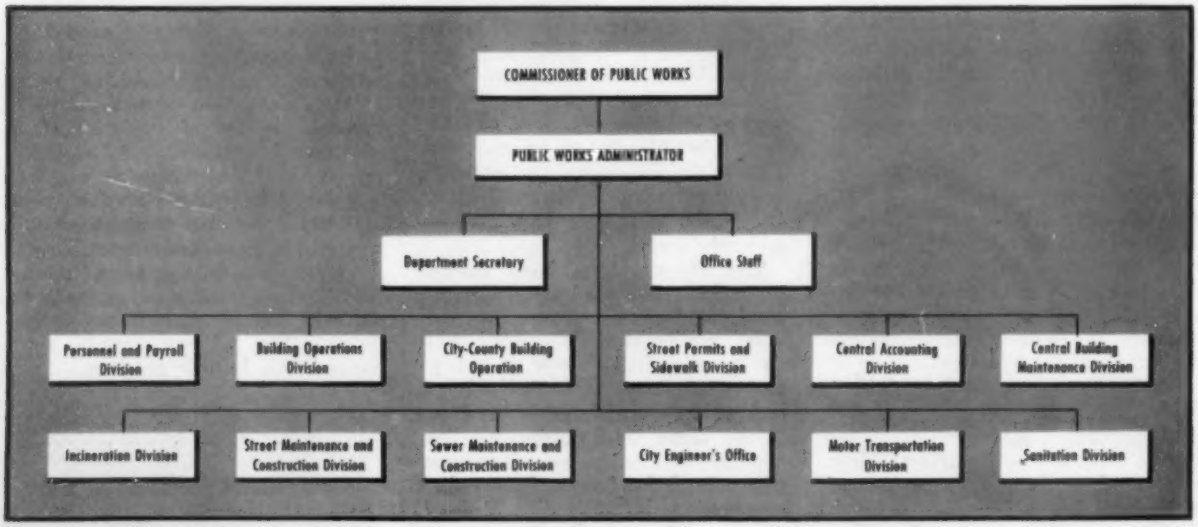


● **DISTRIBUTION** of costs as established by the Detroit Freeway Tri-Party Pact.

Depressed Roadways

The type of expressways built in our city requires a right-of-way width of 350 to 400 feet, generally on a new location. This will accommodate a depressed type of construction for either a six-lane or an eight-lane divided roadway with lane widths of 12 feet each, bordered by curb and gutter, and with continuous refuge shoulders for the use of disabled vehicles. Six-lane roadways are designed to carry 90,000 vehicles per day; eight-lane roadways are designed to carry 120,000 vehicles per day. Since completion of these routes, we have found that volumes have increased up to 50 percent or more above the design capacity.

The work of preparing plans and the various responsibilities of carrying out the construction was divided among the three public agencies, that is, the state highway department, the Wayne County Road Commission, and the city. This, of course, was done under the direct supervision of the state, since by law our state highway commissioner has complete jurisdiction and responsibility for all state trunkline improvements. By designating certain units of government as agents for the state, the work was completed in the most effective manner and in the shortest possible time. Thus, the state handled two projects in their entirety, insofar as bridge and road plans were concerned. The county, likewise, assumed this responsibility on two routes and the City of Detroit assumed this responsibility on one



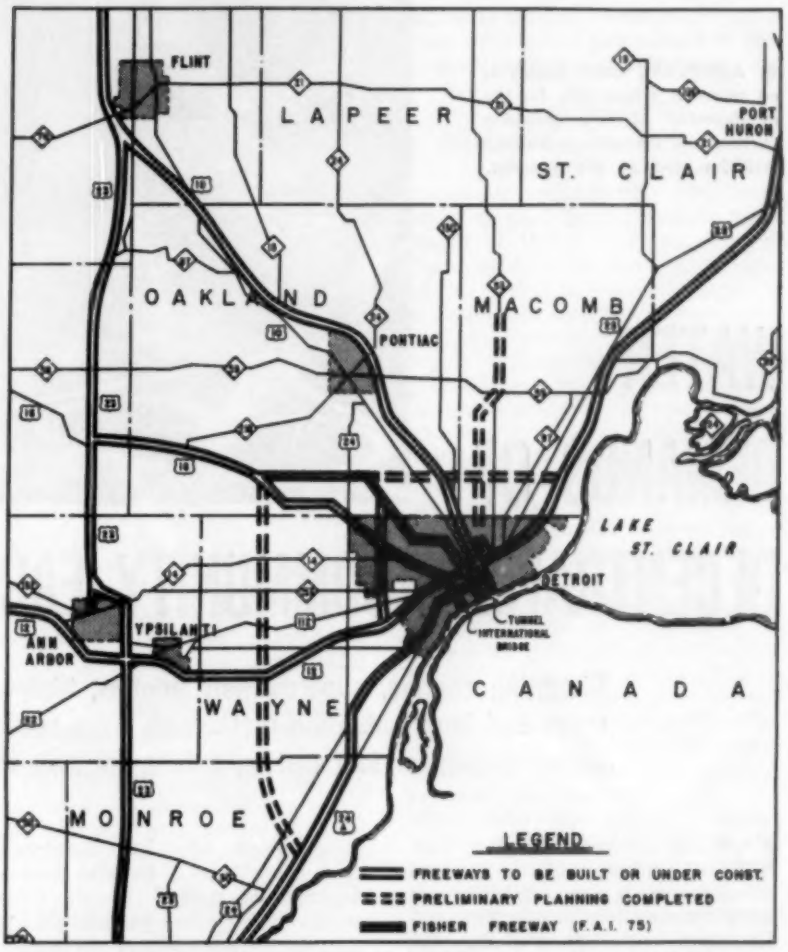
● **ORGANIZATION** chart for Detroit's Department of Public Works. For the 1960-61 budget, 5237 positions were utilized.

route. Right-of-way acquisition on all routes was handled by the right-of-way division of both the state and the county, each on separate routes, since their facilities were much larger than the city's property acquisition personnel. The problem of utility plans was handled in a separate manner.

Utility Problems

Because of the peculiarities of a large city, underground installations are a major problem. The preparation of plans, specifications and cost estimates for the relocation and reconstruction of city-owned utilities was delegated to the city utility departments. It was determined at the outset that these agencies were best qualified because they have the most reliable information available regarding their own installations and they are specialists in their own field. In some cases, additional design and drafting aid had to be provided for these agencies through the use of consulting engineers, but the original planning and design of the work was prepared by the utility agencies themselves. In order to best perform this service, each of the city departments preparing plans was requested to establish a permanent group in their agency who would devote full time to this work. Thus, the expressway planning was divorced from the routine work and could be given full attention. This procedure applied also to specific groups in the city planning agency, in the traffic engineering bureau, and in the department of public works, in order to accelerate the planning arrangements. In the case of privately-owned utilities, the same procedure was followed since the utility companies were best qualified to plan and supervise the reconstruction and relocation of their facilities.

Coordinating of plan preparation and construction schedules, in order that all stages of the work were done at the proper time and in the proper sequence, was left to a very small coordinating committee composed of one member from each agency devoting full time to the project. The state, county and city each appointed a major department head as their expressway coordinator. Our city appointed its commissioner of public works as its coordinator. In turn, the city established a separate highway and expressway division within the department of public works to handle all expressway problems involving the city, county and state, with an expressway engineer serving as full-time coordinator between the various city departments and as a liaison with the state and county.



● **TEN-YEAR Freeway program proposed in 1957 for the southeastern Michigan area shows major construction involved. The freeways extend south to the Ohio Turnpike.**

Best results were obtained when those agencies interested in highway development cooperated and prepared their plans well in advance. Again, a committee-type discussion was found workable in our city. Thus, we developed a small committee consisting of the department of public works, working through the highway expressway division, the city plan commission, and our traffic engineering bureau. This committee considers and examines very thoroughly all matters relating to highway improvements and the construction of expressways and freeways.

Public Relations

The problem of sound public relations cannot be ignored. The general public, which pays for all these improvements, must be given every consideration. They have a right to be heard and a right to understand how the program will affect them and how they are involved. By presenting all the facts with a sympathetic attitude toward the taxpayers, their aid can be enlisted for the benefit of the program. On the other hand, it will often be necessary to overcome the actions of self-interested pressure groups. It is important to explain that during the construction of expressway projects in densely developed areas, the people, business interests and industries will suffer some necessary inconveniences. They must be given sufficient notice of the intentions of the public agencies and time to relocate their homes, businesses, and industries. It should also be understood that heavy construction, such as expressways and freeways, will cause innumerable problems to the city as a whole, and particularly to abutting properties because of the movement and use of large pieces of equipment and machinery, and

(*Please turn to page 228*)

● **ADEQUATE water supply is an essential prerequisite for the development of new shopping centers and other decentralized facilities used by the motorist.**

WATER DEMANDS OF DECENTRALIZED COMMUNITY FACILITIES

Shopping centers, supermarkets, motels, highway service and rest areas and large suburban restaurants have become popular with an automobile-dependent public, calling for new water use standards.

ONE of the most important factors governing orderly regional development is the availability of an adequate water supply. The continuing decentralization of shopping facilities, and of places for obtaining food and lodging, to locations of easy access by automobile, is having a decided effect on regional planning and immediate needs for water system expansion in many areas. In addition, these facilities will need sewerage and frequently separate treatment plants. In an effort to consolidate data accumulated from water use studies and individual observations, the editors of PUBLIC WORKS wrote to all state health departments, selected county and city health departments, some water superintendents and state turnpike organizations. The public health and water works officials were asked for any data available on water use by supermarkets, motels with restaurants, highway service and rest areas and outlying restaurants equipped for serving 500 or more. The turnpike officials were asked for statistics on use of service area restaurants and rest rooms.

Replies to the inquiry on water use were received from 36 states, of which 15 reported the results of studies on some phase of the problem or referred to cities, counties or engineers who had developed some data. Three of the state health departments quoted figures from standards they had established for judging the adequacy of plans submitted for approval, and four others indicated that for this purpose they make use of the tabulation on water use in the "Manual of Septic Tank Practice," Public Health Service Publication 526.

Highway Service and Rest Areas

The primary sources of data on water use by automobile service stations and highway rest areas are the turnpike organizations, and the most complete information was furnished by the Ohio, Indiana and Kansas State Health Departments concerning their respective turnpikes.

C. M. Robinson, Ohio State Department of Health, reports—"500 gallons per 1000 cars using the highway. This is based on the following formula: 10 percent of traffic uses rest area. Cars carry an average of 2.2 persons. Sixty percent of those stopping use toilet facilities at 3.5 gallons each."

The comprehensive study in 1959 by R. H. Finn of the Ohio Turnpike Commission in relating water consumption of service plazas to traffic flow, reported in PUBLIC WORKS, February, 1961, gave the total passenger traffic as 9,685,000 vehicles and water consumption as 15,600,000 gallons, or 1,650 gallons per 1,000 passenger vehicles using the turnpike. This figure, however, includes water consumption by the restaurants.

Robert W. Heider, Indiana State Board of Health, states that a study of the sewage treatment plants of the Indiana Toll Road service plazas as related to traffic volume in 1958, indicated "water usage of approximately 3 gallons per vehicle passing the particular service area. Several factors should be considered in regards to the 3-gallon figure:

"1. The limited number of service areas along the road,

"2. The size of the service areas, and

"3. The high percentage of long distance travelers.

"The average mileage per vehicle using the toll road was 64.19 miles."

Melville Gray of the Kansas State Board of Health, obtained some figures on the Lawrence service area on the Kansas Turnpike in a study of the functioning of the sewage treatment plant in 1957. His conclusions in part were:

"1. Twenty percent of the total turnpike traffic are potential cus-

tomers of the service area, providing sufficient customer facilities are available.

"2. There will be approximately 1½ restaurant customers per car entering the service area.

"3. Total area water use can be expected to average about 10 gallons per restaurant customer.

"4. Of the total area water use, 10 percent may be attributed to use in the functioning of the gasoline service station.

"5. Plant flows show extreme fluctuations, increasing in volume by 4 or 5 times in a matter of seconds."

Peter C. Karalekas, Chief Water Engineer, Springfield, Mass., furnished the results of metering two service areas on the Massachusetts Turnpike, concluding that the amount of water used per customer is 6 gallons.

Other usage reported includes 25,000 gpd at a Sunshine Parkway service area in Florida and 6,000 gpd by service stations along the highway in North Platte, Nebraska. The Georgia State Highway Department uses a design requirement of 10,000 gpd for rest areas along its portion of the Interstate Highway System.

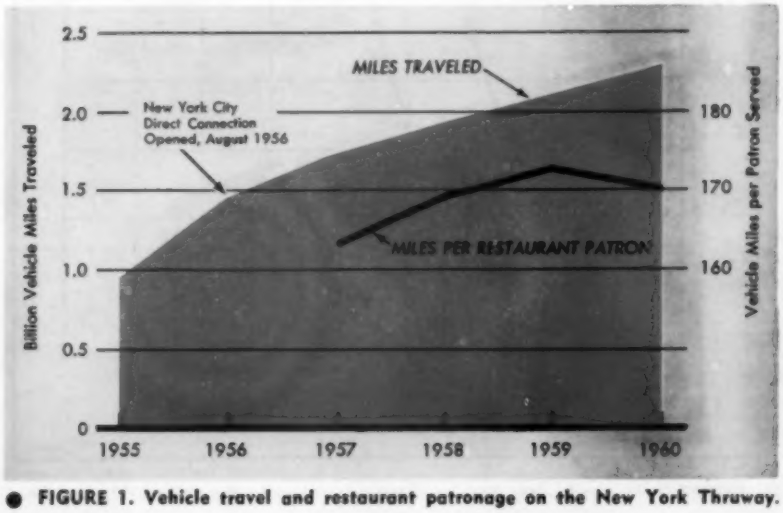
The New Jersey Turnpike, Indiana Toll Road and Pennsylvania Turnpike provided statistics on public use of rest areas. The New Jersey Turnpike Authority estimated that five percent of the vehicles passing will stop; Indiana State Toll Road Commission, 7 percent; and Pennsylvania Turnpike Commission 15 percent. The average number of persons per stopping vehicle estimated by these agencies is 2.5 in New Jersey, 3.0 in Indiana and 1.5 to 3.5 in Pennsylvania (depending on the season). In New Jersey, of the people stopping, the percentage using service area restaurants is estimated as 15; for Indiana, 75; and for Pennsylvania, 80. The use of rest rooms by persons stopping at service areas is considered to be 90 to 100 percent.

The proportion of vehicles stopping is definitely related to the length of trip and the use of the road. The 118-mile New Jersey Turnpike is used to a large extent by commuters, and this is reflected by the relatively low patronage of service areas. The service areas on the 156-mile Indiana Toll Road has a higher relative patronage, and the proportion of vehicles stopping on the 469-mile Pennsylvania Turnpike is three times that of the New Jersey Turnpike.

In the experience of the New York Thruway during the 3-year period following the opening of the direct connection between New York City and those portions serving upstate New York, the ratio of total miles traveled to total patrons served at restaurants increased steadily from 163 to 1 in 1957 to 172 to 1 in 1959. This appears to reflect increasing use of the Thruway by short-run commuter traffic.

The Ohio Turnpike Commission estimates that about half the vehicles will stop at a service plaza on the average trip of about 80 miles and 75 percent of those stopping will patronize the restaurant. On trips of more than 200 miles, practically all vehicles will stop. The percentage of people using the rest rooms and the percentage of those patronizing the restaurants become equal on trips of 165 miles.

Rest room usage has been studied extensively by the Ohio Turnpike Commission with the employment of pedestrian counters. On the Sunday following Christmas in 1959, the rate of use of the rest rooms at one plaza was more than 5 per minute in the 8-hour peak period of 3 to 11 p.m.



● **FIGURE 1. Vehicle travel and restaurant patronage on the New York Thruway.**

Shopping Centers

Although information on water use at shopping centers was not specifically requested, excellent data were supplied by the Florida State Board of Health and the City of Springfield, Mass. For the purpose of this article, a shopping center is considered to be a group of contiguous retail stores of different types within walking distance of a common parking lot, usually zoned as an island within a residential area. The Florida data were from a survey made by Lloyd Frank Vann Associates, during 1957 and 1958, with meter readings being compiled on each business establishment within six shopping centers in the Miami area. The average consumption varied from 143 gallons per day per 1000 sq. ft. for a 98,500 sq. ft. store area to 210 gpd per 1000 sq. ft. for a 500,000 sq. ft. store area. Maximum monthly consumption values ranged from 176 gpd per 1,000 sq. ft. to 306 gpd per 1,000 sq. ft. The usage contributed by large restaurants or cafeterias was studied and found to affect water consumption, with 33 to 67 gpd of the total per 1,000 sq. ft. attributed to them alone. A degree of correlation was noted between the water consumption and total store area. An analysis of data from food stores covering the same period indicated fair alinement with the lower part of the curve (Fig. 2) representing the shopping centers with restaurants and cafeterias.

The Springfield, Mass., data were furnished by the city water department, with three shopping centers metered for a year. The water consumption rates per 1,000 sq. ft. were 2,240 gpd for a 16,000 sq. ft. area, 31 gpd for a 48,000 sq. ft. area and 73 gpd for a 229,000 sq. ft. area. The shopping center with the high usage includes a self-service laundry, and it is understood that none of the Miami centers had such a feature. It is interesting to note that the figures for the other two centers fall considerably to the left of the Miami curve, though parallel.

Supermarkets

As differentiated from shopping centers, a supermarket is considered to be a single retail establishment functioning primarily for the sale of fruit, vegetables and meat for off-premises preparation and consumption. Reports offering water

consumption data on these were received from ten county health departments, five city water departments and five state health departments. This summary is based on observations at more than 60 establishments. The store areas on which the figures were based ranged from 4,600 to 35,000 sq. ft., with the average about 10,000. Water consumption reported varied from 24 to 3,370 gpd per 1,000 sq. ft.

The median or average values of the figures grouped by states varied from 31 to 1100 gpd per 1,000 sq. ft., with six of the twelve bracketed between 100 to 220 gpd per 1,000 sq. ft. While a figure of about 200 gpd per 1,000 sq. ft. fits the Miami curve for a 10,000 sq. ft. floor area, the wide variation is difficult to account for. Degree of business activity, number of employees, clean-up practices, butchering conditions, form of air conditioning and washing and repackaging of vegetables undoubtedly all enter the picture.

Some comments given by those furnishing data provide some explanations. The high figure of 3,370 gpd per 1,000 sq. ft. was furnished by D. C. Calderwood, President of the Pennichuck Water Works of Nashua, New Hampshire. His letter is quoted in part as follows:

"We were amazed at the difference in water usage and have thoroughly checked each installation in order to obtain the reason for the wide variance.

"In two markets there is no recirculation of the cooling water and in each instance the water consumption was approximately 3,370 gpd per 1,000 sq. ft. of floor area. At the other extreme is a market owned by one of the largest chains; they have a closed system which recirculates every drop of water possible and they use only 24 gpd per 1,000 sq. ft. of area. In the other two markets, one used 1,650 gpd and the other 552 gpd per 1,000 sq. ft. The market using 552 gpd has recently put in additional heat exchange capacity and expects to substantially reduce water use.'" The figures were given by Mr. Calderwood in cu. ft. per year and were converted to gpd for uniformity.

C. M. Robinson of the Ohio State Department of Health indicated that usage was 100 gpd per 1,000 sq. ft. of floor area, to which 1,000 to 2,000 gpd should be added if a vegetable grinder is used.

J. B. Miller, Florida State Board of Health, offered the following:

"The figures for the Jacksonville area have some rather large variations which we are unable to explain, however, it is possible that errors were made in reading the meters but a more plausable explanation would be that a breakdown occurred in the private water systems used to provide cooling water for the air conditioning units, and thus requiring the use of water from the city utility."

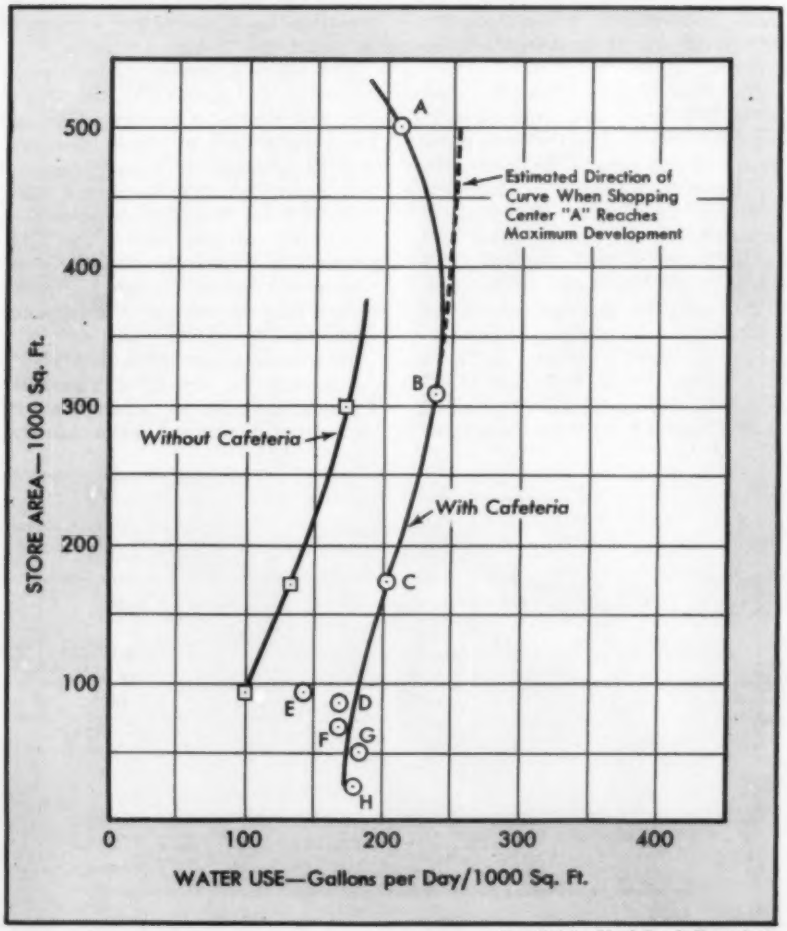
Richard E. Elliott of the Health Department of San Bernardino County, Calif., gave as an instantaneous water demand by supermarkets, 10 gpm per 1,000 sq. ft.

Motels with Restaurants

Motel water consumption data were furnished by ten city and county health departments, three city water departments and eight state health departments. In many instances the size of the motel was given, ranging from 29 to 220 housing units. The consumption, averaged by states, varied from 50 gpd per housing unit in Pennsylvania (based on sewage flow) to 196 in Florida. The Vermont State Health Department uses a plan reviewing standard of 240 gpd per unit. The median of the average figures was 140 gpd per unit.

Some comments of interest were: W. H. Shrewbridge, Director, Bureau of Sanitary Engineering, Virginia Department of Health—"Originally we used a figure of 50 gallons per capita per occupancy of each housing unit exclusive of restaurants. We found that this was not adequate and have ascertained that a minimum of 65 gallons per capita for motels. Motels with restaurants use an additional 10 to 15 gallons per meal."

W. W. White, Director, Bureau of Environmental Health, Nevada State Department of Health—"The only information of this kind ever developed in this State was that by Perliter and Soring when they metered the sewage from some of the larger Nevada clubs at Las Vegas... In general, Perliter's findings were that a Nevada resort hotel with floor show and night club used in the neighborhood of 500 gallons of water per room in those units smaller than 300 rooms, but 300 gallons per room in larger than 500 rooms."



Compiled by Lloyd Frank Vann Assoc.

● **FIGURE 2. Metered water flow in shopping centers in the Miami, Florida, area.**

Large Suburban Restaurants

The classic study on water consumption by large restaurants concerned the restaurants on the first of the big toll roads, the Pennsylvania Turnpike, reported by W. F. Middleton. The yardstick developed was 150 gpd per dining room chair and 350 gpd per counter chair. But these consider restaurants which have a high degree of patronage and where meals are consumed promptly and service is necessarily efficient. Large suburban restaurants offer the other extremes and this is shown by the various replies received in the survey being reported here.

The Santa Clara County (Calif.) Health Department studied meter readings of three restaurants serving 500 or more and found an average water use of 20 gpd per seat. Another California County Health Department, San Bernardino, reports 120 gpd per seat and an instantaneous demand of 1 gpm per seat. The North Carolina State Board of Health estimated 90 gpd per seat in a 130-seat suburban restaurant. The Ohio State Department of Health estimates that a restaurant operating 16 hours per day will use 35 gallons per seat. The County Health Department in the St. Petersburg, Florida area found that 27 gpd per seat is used by 200-seat restaurants. The Vermont State Department of Health estimates a consumption of 30 gpd per seat for restaurants and roadside lunch establishments.

A few correspondents reported on the basis of meals served. The answers included 10 gal. per meal (Pennsylvania Department of Health) 2.6 gal. (Corpus Christi-Nueces County, Texas, Health Unit); and 15 gal. (Virginia Department of Health).

Acknowledgment

The editors of PUBLIC WORKS wish to thank all who participated in this survey. In addition to the individuals mentioned, the following also provided data: G. T. Kellogg, Arkansas State Board of Health; Irvin M. Fallis, County of Santa Clara (Calif.) Health Dept.; Eugene Mason Howell, County of San Mateo (Calif.) Dept. of Public Health and Welfare; M. L. Shadburn, State Highway Dept. of Georgia; George Y. Zane, Hawaii Dept. of Health; Farwell Rhodes, Jr., Indiana Toll Road Commission; Nick G. Johnson, Kentucky Dept. of Health; W. McLean Bingley, Maryland Dept. of Health; Worthen H. Taylor, Massachusetts Dept. of Public Health; D. L. Erickson, Lincoln, Neb., Dept. of Public Works and Utilities; R. D. Carrick, Norfolk, Neb., Water Dept.; F. E. Phelps, Grand Island, Neb., Water Dept.; M. L. Sievers, North Platte, Neb., Municipal Light and Water; Michael J. Judge, New York State Thruway Authority; John C. Haberer, New York Department of Health; J. M. Jarrett, North Carolina State Board of Health; Walter A. Lyon, Pennsylvania Department of Health; Franklin V. Summers, Pennsylvania Turnpike Commission; Henry L. Dabney, Texas Dept. of Health; Edward L. Tracy, Vermont Dept. of Health; W. Earnest Stahl, West Virginia Turnpike Commission; and J. H. Millar. West Virginia Department of Health.

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Ohio's Short Course on Roadside Development

WILBUR J. GARMHAUSEN
Chief Landscape Architect,
Ohio Department of Highways

THE TWENTIETH Annual Short Course on Roadside Development, sponsored by the Ohio Department of Highways and The Ohio State University Department of Landscape Architecture, will be held October 3-6, 1961. The general purposes of the Short Course are to stimulate communication, force attention on current problems and foster good public relations. Specifically, the meeting accomplishes the following:

1) It brings together the specialists working on problems of highway design and the citizens interested in seeing those problems solved;

2) It interests the public in the value of good highway design;

3) It is a definite factor in reducing road costs, particularly maintenance costs, by incorporating sound roadside practices in road construction and design. This involves a mutual knowledge, understanding, and respect between the engineer and the landscape architect;

4) It strives to keep abreast of the times as the public uses the roads. In other words, it strongly emphasizes that our planning not only must include good and safe roads for business, but also must offer an element of comfort and rest.

The conference provides the opportunity for landscape architects across the country to know each other, to understand and appreciate one another's problems, and to exchange ideas. Thus, a bond of unity is established, and the landscape architect increases his vision and understanding beyond his own horizons. There is a need for such a course, and the accessibility of Ohio and its pioneering in roadside development makes it a natural and logical place to meet.

The course has been planned as a part of the educational program of The Ohio State University. The designation, "Short Course," is in line with University policy covering similar concentrated conferences. The Short Course is planned to cover a wide field of subjects pertaining to or related to roadside development which will supply a source of practical first-hand knowledge.

Each year the University schedules a competition problem related to roadside development for the senior landscape students in the School of Architecture and Landscape Architecture. This competi-

● **SOIL SAVER inspection. This group visited a high velocity water way to note results of an installation 5½ months earlier of a jute fiber liner to reduce erosion.**

tion is sponsored by the Ohio Roadside Council, Ohio Association of Garden Clubs, and Garden Club of Ohio, Inc. There are three cash awards given, and the judging is done by a team composed of four landscape architects, one each from the University landscape department, the highway central office landscape section, a highway division landscape architect, and a professional landscape architect.

The program is set up to interest highway engineers, park executives, landscape architects, and the lay public. The trend of the times dictates the general theme of the program. It guides in a very large degree the approach which the various speakers give to their subjects. Throughout the history of this series of short courses, the general theme might have been said to be "The Complete Highway."

A field trip is planned as the final part of the program to review current roadside development practices in Ohio. Stops are made at roadside rests, old and new roadside development projects, research and demonstration plots, and other interesting features en route. In addition, flood control projects, state parks, and business enterprises which would be of general interest to the group have been inspected.

The attendance at the Short Course varies. Numbers in themselves are not important, yet a good attendance leads toward enthusiastic and animated participation in the discussions. In 1960 we had thirty-five states, three provinces of Canada, Puerto Rico, Australia, India, New Guinea, and Peru represented.

For those who attend the conference, proceedings of the meeting are printed to serve as reference material. For those who find it impossible to be present, the publication is prepared as textbook material so that the best current information on roadside development is available. Copies are mailed free of charge to all who request them, including individuals, highway departments, parks, schools and university libraries.

The apparent success of the Short Course is due to the precise, detailed planning that goes into each phase of the conference. This encourages promptness on the part of the participants and assures that the program will be "on time." Not to be overlooked in the success of the course is the enthusiastic interest of Ohio landscape personnel and their willingness to make each person attending feel not only welcome but also an important part of the Short Course.

An effort is made to inform the heads of highway and park departments and all persons within the United States and Canada who are interested in the program about the Short Course and to request them to send representatives. The Bureau of Public Roads is advised and requested to participate and to lend influence in promoting the Short Course. Industry is encouraged to participate by demonstrating products for inspection on the field trip.

We hold a pre-conference meeting to co-ordinate all operations and to inform the Ohio landscape personnel of their particular responsibilities. A post-conference meeting is also held immediately after the Short Course to discuss the phases that did not work smoothly and to lay the groundwork for the next year. These meetings have had much to do with the success of the conferences.

Ohio is proud to sponsor and present the Short Course. If our guests receive new incentive and help in their problems, then our efforts have not been work, but a service willingly and sincerely given as one way of upgrading roadside development across our nation. □□□

● **EROSION reduction. Typical group inspecting a paper mulch installation for reduction of slope erosion. As a demonstration, an application was made to a 1:1 slope.**

PREVENTIVE Sewer Maintenance

ALEX STENMAN
Division Superintendent,
Streets and Sanitation,
Fresno, California

WE OPERATE the sewer system on the old principle or adage: "An ounce of prevention is worth a pound of cure." This is a necessity because the City of Fresno is almost as flat as a billiard table with 435 miles of collection lines, and a single 60-inch outfall sewer carrying an average of 26 mgd of sewage to the City's 35-mgd design-capacity sewage treatment plant.

The City has a combined sewer system. The first vitrified clay pipe sewer lines were constructed in the 1890's and the 60-in. outfall sewer was built in 1916. Everything must function properly to give the 140,000 people in the city and the 2,000 acres of industrial property outside the city limits the best service possible. To do this, preventive maintenance sewer crews work on a precision schedule.

The sewer maintenance men are considered important representatives of their city government and vital members of an organization for maintaining the health and welfare of the community. They are constantly exposed to the public. Their true work can seldom be seen, but their conscientious efforts keep the community in a healthy environment.

Engineering and Programming

One of the most important items in low cost sewer maintenance is proper original engineering. Manhole spacing, grades, sewer sizes and good workmanship are essential to good sewer maintenance. The inspections of new and replacement sewer lines, should include the full moon test, hydrostatic test and ball test whenever practical. The new sewer line should be clean of sand, rocks, cement chunks, etc. A sag in the middle, or cement fingers at joints invariably increase the cost of sewer maintenance.

To set up a good sewer maintenance program, the sewer maintenance department must have an accurate plan of all the sewer lines in the city. This map must show the size of the lines, direction of flow and manhole locations. The Engineering Department has furnished our Sewer Department and keeps up to date, a large-scale map showing the entire city sewer system.

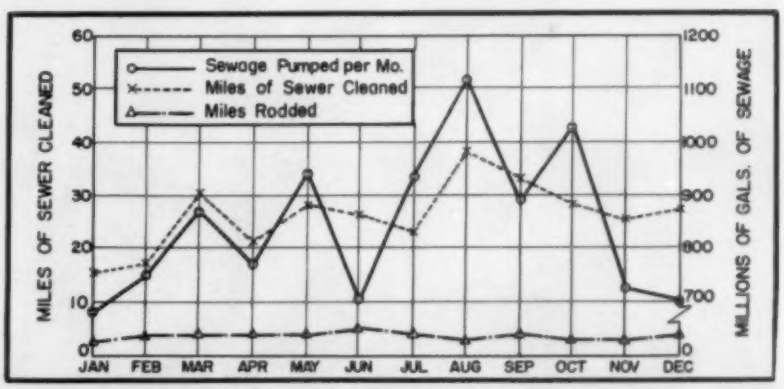
The Sewer Department divided the map into ½-mile districts and numbered each district in such a manner that when a call comes over the phone from any individual, it is merely necessary to give the address to identify location. This is also a help when noting the work in the log; and when a crew leaves in the morning, the district number where they are programmed to work is noted on the log, and if for any reason the crew must be contacted, one knows at a glance how to reach them.

A field book index is kept by the Engineering Department on each sewer line showing the size and date of construction. The Sewer Division also maintains a card index file on each sewer and notes on these cards the dates when cleaned or rodded, or when there was a particular trouble with the line. With this information taken through the years, the troublesome sewers are well spotted on the sewer map and can be cleaned periodically before trouble occurs.

The foreman and superintendent have radio-equipped pickups so when they learn of a stoppage or other complaint, they can proceed directly to the closest crew assigned to routine maintenance and have it at the point of trouble in a matter of minutes. This method is particularly effective during heavy storms since the men are on the spot almost immediately, practically eliminating any chance for property damage.

Safety in Maintaining Sewers

On the sewer maintenance operation, there were 20 minor accidents during 1960, with 6 lost-time accidents. Perhaps the main reason for this good record is the Safety Committee operated by the field men that actually do the work, and the Central Safety Committee that meets monthly to review causes of accidents and methods, ways and means of preventing them. The results of the combined efforts of all the employees and the Committees saved the city $40,000 in industrial accident premiums in the last fiscal year.



● **EXCEPT for main trunk lines, sewers are normally cleaned about every six months. This chart covers, for 1960, the miles of sewers cleaned per month and sewage flow.**

The sewer maintenance crews follow the procedures set down in the department's Operational Procedures Manual which include such general factors as safe tools, personal hygiene and avoidance of practical jokes, horseplay and scuffling. Operation data cover specific instructions on what to do in case of an accident; avoiding careless loading; and daily equipment check.

Also it is required that anyone injured on a city job regardless of how minor the hurt will get treatment at the Emergency Hospital or by the city doctor. The injured employee must fill out an accident report so that the injury will be on record.

Any employee who enters any manhole must use the required safety equipment and must log in the field crew book the use of explosimeter, hydrogen sulfide detector, oxygen deficiency lamp, hose mask and P-type harness. This procedure is carried on at all manholes, including shallow ones. The safety line and the blower are always used in all manholes in which work is being done.

A standard procedure is followed each time the sewer crews tackle the job of cleaning a sewer line. The order of the procedures is as follows: 1) Signs out; 2) flags out; 3) hose boards out; and 4) hoses out. The reverse procedure is used for picking up to eliminate promptly congested working areas and working hazards on all Sewer Division trucks.

● SAFETY equipment for sewer maintenance. Detailed steps are listed in text above.

● ROOTS removed from sewer line by modern cleaning equipment are often surprising.

All of our sewer maintenance trucks are similar in design, with all hand tools in a specific place. The winch, the cables, etc., in each specific truck are exactly alike. In this way, every crew knows where each item is located and when called out on an emergency at night there is no question as to where the tools may be.

Public Relations

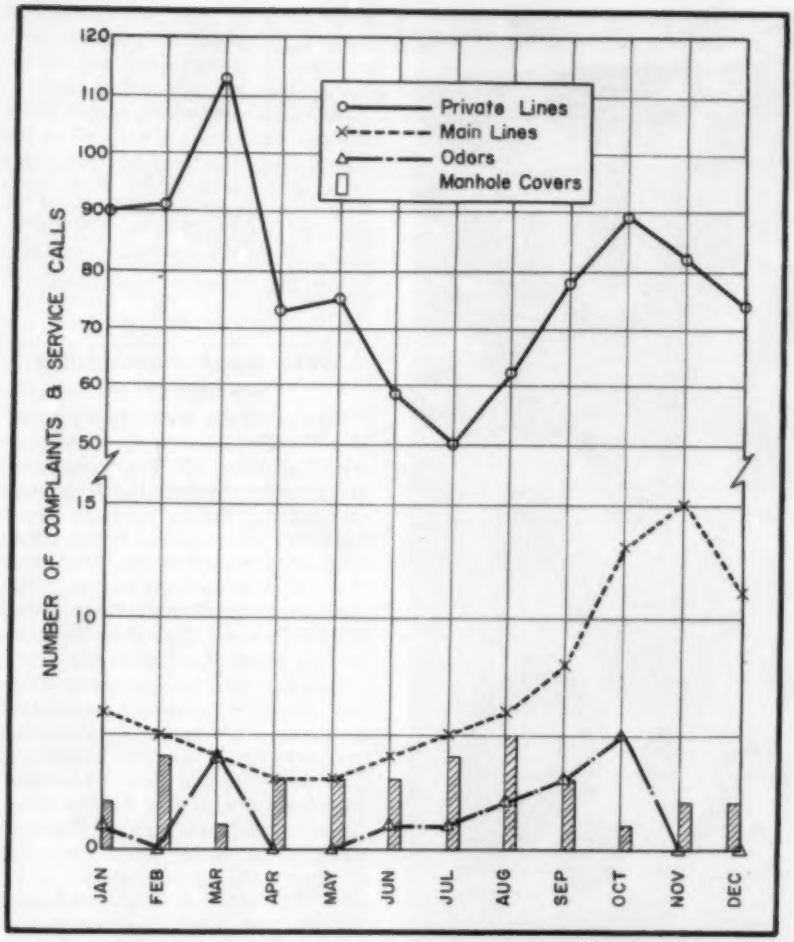
The supervisor is responsible for personnel under his supervision, for personnel to personnel relations, and relations between personnel and the general public. It is his responsibility to know the precedures of the city and the Division. For example, instructions state: A taxpayer has a problem. Do not answer "I do not know" or blame another division. If you don't know the answer, say "I will check this out with the foreman." If the problem pertains to another division, make notes on the problem; obtain the person's name and address and give to your immediate supervisor so the proper division can be contacted.

The Industrial Waste Inspector is an important person insofar as a sewer maintenance program is concerned, and he must practice good public relations. He must know the design of pretreatment equipment used by certain industries, and how to instruct the persons to maintain it properly.

Every industry has a different waste problem. They may need grease traps, sand and grease traps, screens, settling basins, fibre collectors, etc. The Waste Inspector must have the ability to explain to the industries the necessity for installing equipment to protect the sewer lines and sewage treatment plant. After the installation is made, it cannot be forgotten; it must operate properly.

The Service and Chemical Inspector must also understand good public relations and the concerns and needs of the public and the sewer system. Any residential or small commercial complaint is handled by the Service Inspector. He, or an alternate, is available to make calls on sewer complaints 24 hours a day, 7 days of the week. During the last calendar year, the Service Inspector made 1158 calls for smells, private sewer stoppages, etc.; but only 83 of the calls were actually sewer complaints where there was a main line stoppage. The property damage from these stoppages, during the fiscal year, was nil.

The person who receives the complaint, or service call, must be



● **COMPLAINTS and service calls per month. The record shows that private lines need most attention. Also shown are calls in regard to odors and for manhole covers.**

courteous at all times and must know how to get all the necessary information in a minimum length of time. Our analysis chart shows that this person receives an average of 4 calls a day and that he has always performed an exceptional job of getting the information needed properly to expedite the handling of the complaint or service call.

The three positions mentioned are usually the first public contact, and therefore the first impression; for that reason they are exceptionally important. However, at this point, I want to stress that good public relations in a sewer maintenance department must be studied and practiced by every individual in the operation.

Sewer bond improvement issues are needed to keep up with the growth of a progressive, fast-growing city. This year the city of Fresno passed a $6-million obligation bond issue to elminate some of the deficiencies in sewer mains and at the sewage treatment plant. With the city's redevelopment programs, the sewer bonds and the sewer replacement program the deficiences will eventually be eliminated so that sewer operation and maintenance will be easier.

Condition of Sewers

It has been found in Fresno that the vitrified clay sewers, constructed 60 or 70 years ago are in good condition. However, in some cases, the joints have deteriorated. Now some of these sewers leak or are what we refer to as "sanders." Some sewers are without excessive leaking until disturbed by an excavation by some other utility. Once the old sewer joint is disturbed, the whole line becomes a problem. Apparently in some cases, while the joint deteriorated, the sewage built up its own seal with greases and other chemicals.

Maintaining Sewers

It is often asked how often should a sewer line be cleaned on a regular preventive maintenance program. The answer, of course, is that this varies. Many main trunk lines are seldom cleaned in their life span. Some lines must be cleaned as often as every three months when they serve large restaurants or where excessive grease and garbage grinding refuse gets into the sewage. Except for the main trunk lines, the sewers in this area are normally cleaned on the average of every six months.

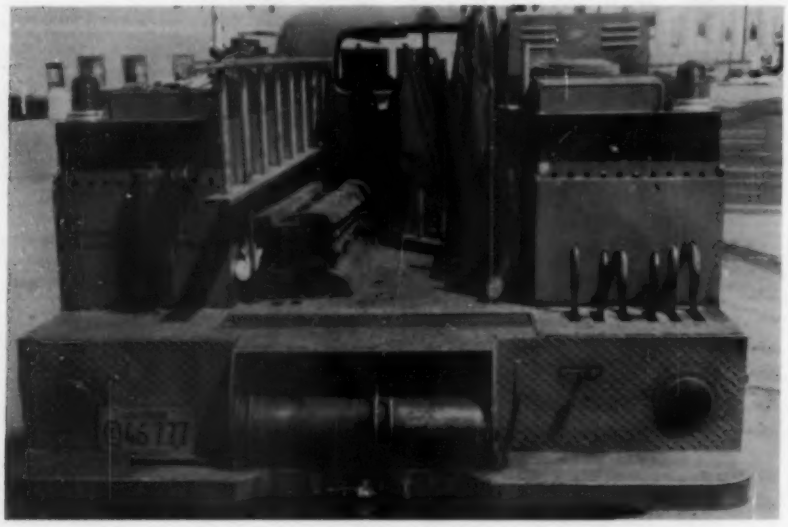
A sewer service charge has been established by the City and the replacement of old sewers is now programmed. A predetermined priority list of the old sewer lines is followed on the replacement program. However, in the meantime, these old sewers are maintained regularly with kid gloves while they are handling some of the City's heaviest flows. It is proper to use a "kid-glove" approach to cleaning and maintaining sewers. The sewer maintenance equipment operator must develop an easy "knowhow" feel of the tools out of sight underground. Rough, heavy tools, and excessive pressures in sewer cleaning can shorten the life span of the sewer lines.

The cable machines mounted on four of our trucks are each operated by a crew of three men. These trucks use a power take-off to run a double-drum winch. The cable on the operating equipment has eight controls for various operations. These four pieces of equipment operate cleaning tools underground by feel and touch. A good and experienced operation crew is needed to run this equipment effectively. The men must have knowledge of the sewer system, and understand their responsibility. They must know when and where to use the several special tools. They must take care of the pipe cleaning equipment, and be sure the cable won't kink or break. They must have pride in their equipment and make sure that it is always ready to operate for any emergency, day or night. Good operators know that if they clear a sewer blockage quickly, the chances of property damage will be nil.

The Flexible "Seweroder" uses steel rods to clean or clear the stoppages; however, generally the sewer cleaner follows up with cable tools to finish the job of cleaning the sewer lines. The Seweroder is operated by a three-man crew that must be proficient with the machine's operation. The crew must know when and where to use the right tools, which may be screws, root saw, sand screw, auger, etc.

In the final analysis, each sewer system must have its own techni-

● **BUCKET machine mounted on one-ton truck is driven by power takeoff from engine.**



● **REAR END view of a one-ton sewer maintenance truck showing winch and controls.**

ques and methods for maintenance. The maintenance costs of each system will differ, depending on many factors. The function of each system can be checked as to comparative performance the previous year by simple charts.

The Fresno Sewer Division keeps production records and costs of all of their operations. For example during 1960, the City had: One main line stoppage per 121,000,000 gallons of sewage; One service call per 8,700,000 gallons of sewage; one actual sewer complaint per 80,500,000 gallons; one manhole cover complaint per 300,000,000 gallons and one off-day accident per 57,000,000 gallons.

Of the approximately 1,300 sewer complaint calls that came into the Sanitation Department during the calendar year, 80 percent did not involve the city sewers. All these calls were investigated by the sewer service inspector because of the liability involved had they been the city's responsibility.

The sewage treatment plant received over 10 billion gallons in the 1960 calendar year, against about 9.8 billion gallons for the 1959 calendar year.

The thoroughness and workmanship of the crews are reflected by the results obtained. For example, the City's combined sewers have over 230 inlets from the streets in the outlying residential areas, not including the down-town area. This means that hundreds of manhole covers are opened not only for normal maintenance but to check for sticks, cans, and other stoppages after each rain. The covers are always checked to see if they are seated properly so as not to rattle or become loose.

We all know that you cannot run a sewer maintenance program with charts — it takes people and equipment, with methods and know-how. However, if a standard, simple chart is made each year, it will reflect the trends that occurred from past years as to production, sewer flow, manpower, miles of sewer cleaned or rodded, etc., and it will help in studying and analyzing for future sewer maintenance operations.

• • •

Water Supply from a Saline Conversion Plant

Converted sea water was pumped into the Freeport, Tex., water system last May 31. The conversion plant, which utilizes the long tube vertical distillation process, has a capacity of 1 mgd. Construction contractor was Chicago Bridge & Iron Co.; management and operating contractor is Stearns-Roger Mfg. Co. of Denver. The plant operates on sea water having 35,000 mg/L of salinity, producing a plant effluent having a maximum salinity of 50 mg/L total dissolved solids. The operating ratio is 9.5 pounds of product water per pound of steam. Initial plant cost was $1.255,712.

The water supply of Freeport comes from seven wells about 250 ft. deep with a total capacity of 3.5 mgd. The city is now purchasing 500,000 gpd from the conversion plant. This converted water is pumped to a 500,000-gallon ground storage tank, mixed with an equal quantity of well water and pumped into the distribution system. The resulting 50-50 blend gives an excellent quality drinking water.

Though converted water was first pumped into the system on May 31, public announcement was not made until June 5. In the meantime, no complaints were received from consumers regarding taste, hardness, chemical content or other qualities; and no complaints had been received during the first month of operations.

W. R. Blackwell is city manager of Freeport.

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Value of Public Works Equipment

As of the end of 1960, the Town of Manchester, Vt., had an inventory of public works equipment totalling $72,600. This included a tractor and bulldozer, grader, power shovel, roller, front end loader, motor trucks, snow plows, a sweeper and many minor items.

MODERN LIGHTING
FOR DEARBORN'S CIVIC CENTER

ONE OF THE nation's newest civic centers, an ultra-modern "showplace" in Dearborn, Mich., has only been three-fifths completed—but the city's forward-looking leaders planned ahead with full parking and roadway facilities lighted by modern mercury vapor luminaires.

The multi-million-dollar center, built as close as possible to Dearborn's geographical center, is situated on a 50-acre site donated to the city by the Ford Motor Company in 1957. Constructed so far are three buildings—a youth center, police-court building, and a powerhouse. Still to be built are a civic auditorium and a new city hall. Master plan and individual projects were designed by Harley, Ellington, Cowin, and Stirton, Inc., Architects and Engineers.

Although money for the two remaining buildings has not yet been authorized by the town's voters, Dearborn's leaders planned for the entire project with a perimeter road and parking lots that will accommodate 1,383 automobiles. To light the roadway and parking area, the city installed 96 General Electric 400-watt mercury vapor luminaires with color-corrected lamps.

Mayor Orville L. Hubbard, finishing his 20th year in office, characterizes the new lighting as an appropriate, smart touch to the entire project. When completed, the civic center, according to Hubbard, will be the most practical, as well as one of the most appealing civic centers in the United States. It will provide recreational facilities, central government accommodations and operations for police, communications, courts and fire protection.

Begun in 1958, the center's three buildings cost $3,421,000 including $1,175,000 contracted for the Youth Center. A proposal to build a civic auditorium for $3,950,000 has still to win voter approval, and the new city hall project has been held in abeyance until the present city hall can be sold.

The Youth Center includes a multi-purpose room with a dome-shaped roof at one end. It is used for roller skating, dancing and other large group functions. The rest of the building is one story and includes meeting rooms, a billiard room, table tennis area, kitchenettes and a reading room. A rifle range and an archery range are in the basement.

Besides the power house, which provides heat and air conditioning for the entire civic center, there is a third building, which houses the police department, courts, a fire station, and Dearborn's signal bureau.

The complete outdoor lighting installation is made up of 40 single-mounted and 56 twin-mounted luminaires. The 20,000-lumen units are on davit-type poles spaced approximately 125 feet apart. The mounting height is 30 feet. Installation was done by the city's signal bureau.

Says City Engineer Howard Lilley: "This is good, modern lighting. It provides maximum safety and the desired decorative appearance." When the perimeter road is completed, more luminaires will be installed, says Lilley. □□□

● **MERCURY vapor luminaires mounted on modern standards provide adequate lighting for Dearborn's Youth Center and for the adjacent roadway and the parking area.**

● **LIGHTING for the Civic Center parking area is provided by these 20,000 lumen GE mercury vapor lights, type M-400. The Youth Center is shown in the background.**

Keeping a Sanitary Landfill SANITARY

BAYARD F. BJORNSON
Training Branch, and
MALEN D. BOGUE
Technology Branch,
Communicable Disease Center,
Public Health Service
Atlanta, Georgia

IN RECENT YEARS, many cities have adopted the sanitary landfill method of refuse disposal as an essential part of a well-balanced refuse handling system. Together with efficient storage and collection, this method will prevent disease and greatly improve environmental sanitation conditions in a community. In a properly operated sanitary landfill, garbage and rubbish combined are reduced to the smallest practical volume and covered with a layer of compacted earth at the conclusion of each day's operation. Neither hazards to public health and safety, nor nuisances are created at a properly operated sanitary landfill. When refuse in a landfill is covered daily with 6 to 8 ins. of earth and the earth layer is thoroughly compacted, flies and rats carrying disease and filth are not able to feed and breed in the buried refuse. In contrast, refuse dumps produce tremendous numbers of flies, mosquitoes and rats that can spread communicable diseases, and also present the hazard of fires and the nuisance of odors and blowing papers.

Although this paper emphasizes sanitary landfill problems, it is important to realize that all phases of refuse handling must be efficient. A close look at the three parts of refuse handling—storage, collection, and disposal—brings to mind the familiar warning, "a chain is only as strong as its weakest link." Inadequacies in one of these interrelated activities in the refuse handling system can produce problems in the rest of the system.

Improper storage of refuse can greatly increase the cost of refuse collection; inadequately planned refuse collection can adversely affect sanitary landfills, and a combination of these handicaps and high costs can result in inadequate refuse disposal. It is also axiomatic that either failure or only partial success of a sanitary landfill can create problems with regard to refuse storage and collection. Many communities have solved their refuse disposal problems with well-operated sanitary landfills. Unfortunately, however, a number of cities have either started sanitary landfills incorrectly or permitted them to deteriorate in a short time to nothing more than mechanized dumps. This disillusioning pattern is one that is being repeated too frequently for comfort, yet the reasons for it are fairly evident and corrective measures are available.

● **A WELL-operated sanitary landfill using the trench method. Refuse is dumped into the trench, compacted by the tractor and covered with dirt from the trench extension.**

● **ANOTHER well-operated landfill, this one utilizing the ramp method. Refuse is dumped on the slope, compacted by the tractor and covered from a suitable source.**

"Sanitary" in Name Only

Unfortunately, too many communities have adopted only the name—"sanitary landfill"—not the method. The authors have visited

a number of so-called sanitary landfills where the communities have spent the money to purchase land and equipment and to hire personnel only to find the operation little better than a refuse dump except for increased mechanization. These communities have, with good intention, bought a landfill site and a crawler tractor with bulldozer or loader attachment, hired an operator, and started operations. Then, usually for one or more reasons, the venture has not been a success.

As a result of these shortcomings the operation has become not a sanitary landfill but merely a mechanized dump. According to Dawes (1), the open dump is the "negation of method, and should not be practiced since the terms 'open dumping' and 'environmental sanitation' are mutually contradictory." When the public is not informed in advance of the distinction between a sanitary landfill and an open dump, or the sanitary landfill operation deteriorates, they may demand the offensive "dump" be isolated. As a result, a number of communities have either lost excellent centrally located sanitary landfill sites, or have been forced to abandon this approved economical method. Once this unfortunate and unnecessary setback occurs, the stigma and public resentment remain and it may never again be possible to obtain convenient sites for economical sanitary landfill operation.

Recommended Plan of Action

Actions which can be taken to avoid these needless difficulties are:

Plan the sanitary landfill operation as an engineering project. Competent consultation is available from departments of health and representatives of equipment companies. Select sanitary landfill sites in locations of maximum utility to the refuse collection system and to the present and future needs of the community. Locate landfill sites in industrial or utility-zoned areas or in locations that have been zoned for landfill operation in advance of residential or industrial development. Site location should be done by joint action of local departments of health, public works, and local or metropolitan planning commissions. Provide long-range planning with regard to the ultimate use of reclaimed sites as parks, playgrounds, parking lots or other community improvements. Select landfill sites for ease of operation as well as for location and size.

Inaugurate a program of official and public education as far in advance of actual sanitary landfill operation as possible and continue it. Discourage synonymous use of the terms "dump" and "sanitary landfill."

Select the maximum-sized equipment for the job, if possible, rather than the minimum-sized equipment, keeping in mind the operations required for the site (excavation, compaction, cover transport) and the probable increase in refuse volume as communities expand. It is generally cheaper in the long run.

Assign only competent, responsible personnel to sanitary landfill work. Both the equipment operator and his immediate supervisor must be well-versed in all phases of sanitary landfill operation.

Train personnel thoroughly in equipment operation and maintenance and efficient sanitary landfill operational procedures.

Set high standards of operation from the start and maintain them. Thorough compaction and daily coverage of refuse are two fundamental requirements. Regular supervision by qualified personnel is essential and frequent review of sanitary landfill operations by city, health and visiting officials is to be encouraged. If the landfill is featured as a showplace for visitors, the operator tends to take more pride in his work and will try to maintain high standards of operation. The equipment must not be diverted to other community work when it is required at the sanitary landfill site. Regular (monthly minimum) inspections by the local department of health will help to maintain such standards.

Some state departments of health have adopted regulations concerning refuse handling, including sanitary landfill. Many publications with information on sanitary landfill planning and operation are available. These publications list other useful references in their bibliographies. Most of the sanitary landfill equipment manufacturers have published detailed brochures on sanitary landfill operation and some have descriptive motion picture films available. For example, the Caterpillar Tractor Company film "A Decent Burial" may be obtained on loan from local equipment distributors. Several films on sanitary landfill, available on short-term

Factors Which Will Cause Unsatisfactory Operation of a Sanitary Landfill

- Insufficient planning and design.
- Inadequate supervision, equipment and personnel.
- Inadequate training of personnel.
- Failure to follow proper procedures.
- Deterioration of operation.
- Inadequate education.
- Poor selection of site.
- Inadequate training of replacement for equipment operator or landfill supervisor.
- Diversion of equipment.
- Decline of official interest and public approval.

loan to groups engaged in public health activities from the Communicable Disease Center, U. S. Public Health Service, Atlanta, Georgia, are listed at the end of this artic e.

Wherever possible, planning for sanitary landfills should be part of a complete program for improvement of refuse handling. For example, if refuse trucks are of small capacity or lack quick unloading devices, or if too many collection trucks arrive at the sanitary landfill at one time, or the trucks occupy the unloading area for a long time, a large unloading area is required. This makes it difficult or impossible for the equipment operator either to keep the size of the working face of the landfill to a desirable minimum or to adequately compact the refuse. The use of refuse transfer stations for transferring collected refuse from route collection vehicles to large trailers or railroad cars for haul to the disposal sites makes longer hauls to sanitary landfills more competitive with systems using centrally-located incinerators.

It is not the intention of this article to discourage any community from adopting the sanitary landfill or incineration method of refuse disposal. On the contrary, it is intended to help those initiating or operating sanitary landfills to avoid some of the difficulties that have often hampered operations in other communities.

Summary

Sanitary landfill is a most satisfactory and economical sanitary method of garbage and rubbish disposal for most communities under 100,000 population and for many larger cities. Although the operation is relatively simple, the sanitary landfill should be planned and operated as an engineering project. Through timely education and continuous high standards of operation the public should learn the marked difference between an "open dump" and a true sanitary landfill.

Publications on Sanitary Landfill

American Society of Civil Engineers. 1959. *Sanitary Landfill.* 33 West 39th St., New York 18, N. Y., 60 pp.

Johnson, Wilfred H. 1957. *The Sanitary Landfill.* U. S. Department of Health, Education and Welfare, Public Health Service, Atlanta, Georgia, 11 pp.

U. S. Department of Health, Education and Welfare and American Public Works Association. 1953. *Refuse Collection and Disposal for the Small Community.* 39 pp.

University of California Sanitary Engineering Project. 1952. *An Analysis of Refuse Collection and Sanitary Landfill Disposal.* Technical Bulletin Number 8, Series 37, 133 pp.

Suggested Audiovisual Aids

The films listed below are available on free, short-term loan within the United States. Requests should indicate exact dates that films are to be used and allow ample time for shipment. These requests should be addressed to:

Communicable Disease Center
Audiovisual
Atlanta 22, Georgia

SANITATION TECHNIQUES IN RAT CONTROL (M37.1d), Motion picture, Black and white, Sound, 12 minutes, 432 ft., 1953.

REFUSE DISPOSAL BY SANITARY LANDFILL (M228), Motion picture, Color, Sound, 13 minutes, 472 ft., 1956.

THE SANITARY LANDFILL: PART I, Operating Procedures (FS F-229a), Film strip, Color, Sound, 7 minutes, 59 fr., 1957.

THE SANITARY LANDFILL: PART II, Small Community Landfills (FS F-229b), Film strip, Color, Sound, 6 minutes, 41 fr., 1956.

A SURVEY OF REFUSE DISPOSAL METHODS (M-328), Motion picture, Color, Sound, 10 minutes, 358 ft., 1959.

Reference

1) Dawes, J. C. 1950. The storage, collection and disposal of domestic refuse (including garbage) in the U.S.A. World Health Organization Report, Ministry of Health, London, England.

Construction of a LIME STABILIZED BASE

WM. T. WINNING, JR.

Street Supervisor, City of Webster Groves, Missouri

A TEST section of lime stabilized base construction was completed in the summer of 1960 by the City of Webster Groves, Missouri. The work was done on Fair Oaks Avenue, a residential street 345 feet long.

The existing street consisted of cinders, gravel and crushed limestone to an average depth of 3 inches with some liquid asphalt penetration patching and an overall asphalt sealcoat applied some years ago. The soil underneath this surface was a clayey loam with a general classification of A-7-6 and a group index of between 16 and 20. The street was constructed to a width of 26 feet from back to back of the integral penetration curb and has a total area of 1000 square yards.

Base Preparation

Construction began August 1, 1960, by scarifying the existing surface to a depth of approximately 8 inches. After the surface was scarified it was then bladed level. On August 2, a Seaman Pulvi-Mixer was brought on the street and the area was pulverized to a depth of 8 inches. After thorough mixing of the base, hydrated lime was spread by a truck spreader at the rate of 10 lbs. per square yard, or at an approximate rate of 2¾ percent by volume. Lime was then blended into the existing base for the entire 8-inch depth until the surface was of uniform color and texture.

At this point water was sprayed on the surface until the entire surface was saturated. The base was then remixed with the Seaman Pulvi-Mixer until water was distributed throughout the entire 8 inches of the prepared base. The soil moisture condition we were trying for and did achieve was one where soil compressed in the hand would remain in one ball and yet

not stick to the hand. Immediately upon reaching this point, a pneumatic-tired roller weighing 9 tons started compaction of the entire section. As soon as the roller had made one pass over the entire surface, the motor grader operator started blading the prepared base to line and grade. The rolling and grading were not quite completed when the grader lost a front wheel bearing, halting operations for the day.

The next morning when grading was begun, it was interesting to note that the ridges left from the pneumatic-roller tires were only being polished on top by the grader blade instead of being cut to the level of the street, indicating the stability already achieved just 10 hours after processing was completed. After grading and rolling were completed, the surface was saturated morning and evening for the following two days. Traffic used the street the entire time except when actual construction was in progress.

The cost of base preparation including labor, equipment and materials was $0.587 per square yard.

Surface Course

Work was started on the surface course on August 8, 1960. A 1½-inch open-graded crushed limestone was spread to a compacted thickness of 2 inches. After spotting and rolling, this stone was penetrated with 2 gallons per square yard of 85-100 penetration liquid asphalt and immediately covered with approximately 50 pounds per square yard of ½-inch crushed limestone. Following the penetration, the street was immediately opened to traffic until September 23, 1960.

On September 23, 1960, the first of two sealcoats was applied. This consisted of 0.5 gal. of RS-3K, emulsified liquid asphalt, per square yard of ⅜-inch "torpedo gravel," a reddish brown Meramec River chert gravel.

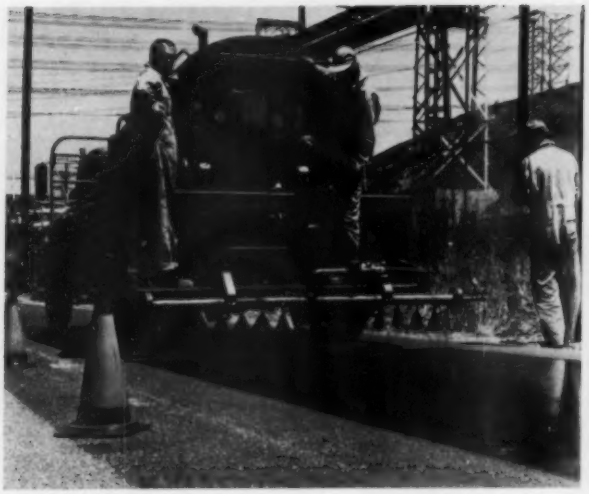
Cost for the surface course to this point was $1.15 per square yard. The final sealcoat on this section applied during the summer of 1961, consisted of 0.4 gal. liquid asphalt covered with 25 to 30 pounds per square yard of torpedo gravel at an estimated cost of $.09 per square yard, thereby making the total estimated cost per square yard for the entire section $1.83 per square yard.

After surface course construction was completed, top soil was placed between the penetration curb and sidewalk. This was levelled and fine graded so property owners could sow the areas with grass seed. □□

● **THREE STEPS** in base preparation work are shown here. Initially the surface is scarified and then broken up with a Seaman Pulvi-Mixer to a depth of 8 inches.

● **STEP TWO** is the spreading of hydrated lime on the prepared surface. Using a truck spreader, lime is applied at the rate of 10 lbs. per sq. yd., or 2¾ % by volume.

● **WATER** is then applied to saturate the depth to be treated; the pulverizing process is repeated and the surface rolled. A motor grader follows the roller closely.



● SPRAYING epoxy resinous paving cement binder. Machine meters and blends the epoxy and applies it at desired rate.

● POT HOLE patching with a sand-filled epoxy binder on the surfacing of the Bronx-Whitestone Bridge, New York City.

USES OF EPOXY RESINS

Epoxy resins have found wide acceptance as an important engineering material in repair, maintenance and protection of metal and masonry surfaces. In the following article the remarkable properties and widespread applications of epoxy resins and a companion material, polysulfide sealants, are summarized.

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THE BONDING versatility of epoxy resins has quickly met with approval in many areas of the country and for many applications. A long, hard look at what is happening with epoxy resins shows many important developments.

Epoxy resins are becoming widely accepted as new materials of construction and tools for maintenance. Architects and engineers are specifying them for new construction and reconstruction projects. Contractors and supply houses are recommending them for maintenance work and corrective applications. The Federal government and many state highway departments have written specifications for epoxy resin materials.

What is the history of epoxy resins? As chemical compounds, epoxies, as we know them, existed as early as the latter part of the last century. However, it was only after the end of World War II and the early 1950's that production of the required raw materials made epoxies available on a commercial scale.

Epoxy coatings for industrial finishing became the first large volume use for epoxy resins. The most common epoxy coating systems are comprised of two components which must be mixed together shortly before using. Once blended, a chemical reaction commences which eventually cures or hardens the blend. Most epoxy coatings must be used within a few hours, or a few days, in order to avoid having them set up in the can. However, the inconvenience of blending the two components is rewarded by a cured coating film which features exceptional properties. Epoxy coatings demonstrate remarkable adhesion to metals, woods, plastics, concrete and ceramics. The hardened film is extremely resistant to water, brine, weathering, abrasion and most solvents, chemicals and acids. The resulting smooth, tile-like appearance resembles a baked finish even though only room temperature curing is required.

Epoxy coatings can be pigmented to give almost any desired color. Epoxy coatings with good adhesion and chemical resistance were found especially useful for protecting chemical processing equipment, tanks, piping, marine equipment, laboratories, dairy equipment, food-processing machinery and all types of military equipment. One of the first notable uses for epoxy coatings was in the protection of off-shore oil well drilling barges which are subject to severe attack by the salt water and corrosive conditions near the water surface.

It wasn't long before it was discovered that epoxy coatings could be successfully applied to concrete surfaces. The epoxy coatings proved to be very resistant to the alkalinity of concrete. Some of the first uses included finishing basement floors and walls, garage floors and swimming pools. In environments where laitance is present, it is preferable to first etch the surface of the concrete using a dilute solution of muriatic acid. Once applied to a good surface, epoxy coatings defy removal. It is usually necessary to chip away the concrete to remove the coating.

Highway engineers are also finding epoxy coatings useful. When applied to concrete surfaces, the coating seals out moisture and prevents destruction from freeze-thaw

cycling and chemical attack. The armour-plating properties of epoxy coatings have been used for waterproofing concrete bridge piers, abutments, curbings, railings and sidewalks.

A large volume use of epoxy resins is for surfacing and repairing roadways and bridges. Epoxy resins alone are much too strong and rigid for use on pavements. Epoxy coatings are not suitable for wearing surfaces because they are too thin. However, special epoxy systems have been created which can be used for surfacing and repairing concrete and bituminous roadways.

The development of an acceptable formulation for surfacing roads did not come easily. Since the epoxy alone is not suitable for use on roadways, it was necessary to find plasticizing agents which would help the epoxy "join" or work with the roadway instead of fighting it. Until a satisfactory system was developed, the epoxy surfaces usually stuck tightly to the concrete, but as soon as temperature fluctuation occurred, the weaker concrete failed. One commercial formulation which proved itself was developed with the cooperation of the State of New Jersey. A one-mile stretch of Route 22 in Union, New Jersey was chosen for field testing because it is a main artery which handles over 50,000 vehicles per day. Different binder formulations, roadway cleaning methods, type size and shape of aggregate, and method of application were investigated. In 1957, a specific formulation along with application techniques was established which, with minor modifications, continues to be widely used for surfacing and repairing roadways today.

The most common method of using epoxy road surfacing systems is to spread a thin film of the blended resins and hardener over the surface of the previously-cleaned roadway and subsequently drop aggregate onto the liquid film of epoxy compound. Within a few hours the epoxy compound cures to form a tough, thermoset film. The epoxy bonds the aggregate tightly and resists the wear of traffic. The epoxy and grit surface also presents a very skid-resistant surface.

Epoxy surfacing compounds have been used on roadways and bridges in over 30 states. In the state of

Table 1—Summary of Epoxy Products for Construction and Maintenance

Operation	Material
Portland Cement Concrete	
Sealing roadways.	Epoxy paving cement plus aggregate overlay.
Sealing walls, ceilings, floors, piers and curbing.	Epoxy coatings.
Sealing damp concrete walks, ceilings and floors.	Epoxy polysulfide adhesives.
Bonding New (Set) Concrete to Old (Cured) Concrete.	Epoxy polysulfide adhesives.
Bonding Old to Concrete or Other Surfaces.	Epoxy paving cement, alone or with sand as grout.
Filling and Sealing Narrow Cracks (under 1/18" wide).	Epoxy paving cement binder alone.
Filling and Sealing Wide Cracks (Over 1/18" wide).	Epoxy paving cement with sand as grout.
Patching Shallow Pot Holes and Shallow Depressions.	Epoxy paving cement with sand as grout.
Quick Patching Deep Pot Holes and Depressions.	Epoxy paving cement with sand as grout.
Patching Deep Pot Holes, and Depressions—Using Patches.	Epoxy polysulfide concrete bonding adhesives.
Skidproofing Roadway.	Epoxy concrete cement with abrasive grit overlay.
Color-Coding Roadways.	Epoxy concrete cement plus overlay of colored granules.
Grouting Reinforcing Roads and Pins.	Epoxy concrete cement plus sand as grout.
Pouring Thin Slabs Over Old.	Epoxy polysulfide adhesives.
Wearing Surface on Concrete Roadways.	Epoxy concrete cement plus aggregate overlay.
Bonding and Sealing Joints of Concrete Blocks, Bricks, and Tiles.	Epoxy plastic grout
Flexible Seal in Expansion Cracks or Moving Joints.	Polysulfide sealant.
Asphaltic Concrete	
Wearing Surface on Roadway.	Epoxy Concrete Cement plus aggregate overlay.
Skidproofing Roadways.	Epoxy Concrete Cement plus aggregate overlay.
Patching Pot Holes and Depressions.	Epoxy Concrete Cement plus sand as grout.
Bonding Concrete Curbs, Dividers, Signs and Blocks.	Epoxy Concrete Cement with or without sand as grout. Epoxy Plastic Grout.
Filling Narrow Cracks (Less Than 1/16" Wide).	Epoxy Concrete Cement binder alone.
Filling Wide Cracks (More Than 1/16" Wide).	Epoxy Concrete Cement with sand as grout.
Sealing Membrane for Roadways.	Epoxy Concrete Cement plus grit overlay.
Steel and Iron Surfaces	
Wearing Surface on Steel Roadways.	Epoxy Concrete Cement plus emery overlay.
Corrosion Resistant Surface on Metals.	Epoxy Coatings.

Note: Binder—The fluid blend of epoxy Part A and hardener Part B with no added sand or aggregate.

Grout—A mortar made from a mix of epoxy binder plus sand or other aggregate.

Overlay—A layer of binder applied to a surface and subsequently covered with aggregate spread over the wet binder.

● **EPOXY coatings have been used with success for application to swimming pools. When properly applied, these coatings have remarkable water and weather resistance.**

Kansas one bridge was surfaced on a test basis in 1959 and six more bridges were surfaced in 1960. Other states using epoxies include New York, California, Illinois, Missouri, Massachusetts, Michigan, Kentucky and New Jersey.

Epoxy road surfacing materials are also used as waterproofing membranes on bridge decks and concrete roofs. A thin film of epoxy can be applied to the concrete surface, and thereby provide an impenetrable barrier against water and other liquids. On bridges, this waterproofing membrane can be covered with an asphalt wearing course. This technique is being used extensively in the State of Illinois and additional work is being planned in New York and other states.

Another important use for epoxy road surfacing material is for patching and repairing. Epoxy cement can be used as a binder to pour into thin cracks. Hairline cracks might have to be chipped out at the top to form a reservoir for the fluid epoxy. With large cracks, pot holes, and scaled areas it is usually preferred to incorporate selected grades of sand into the binder so as to make an epoxy cement mortar.

Almost any epoxy system without solvents can be used for bonding cured, dry concrete to itself or to other surfaces. Epoxy paving or surfacing systems are particularly adaptable. However, a combination of epoxy with polysulfide resin can be formulated to create an adhesive which actually bonds wet concrete to other surfaces. This adhesive can be used to bond new, freshly-poured concrete to old concrete surfaces. The new concrete can be finished out to feather edge provided it is properly cured under moist conditions. Adhesives can be used for patching large pot holes without the necessity of cutting away the hold to square the corners. Eyebolts, dowels, anchor bolts, poles, railings and machinery can be set in concrete with the aid of this type of adhesive. The U. S. Army Corps of Engineers has developed a preferred formulation which is being used extensively for repair and reconstruction of dams, air field runways, and other structures. Many state highway departments have written specifications around adhesives for bonding wet concrete to old concrete.

The concrete bonding adhesive is normally applied to the old surface after it has been cleaned. The new, wet concrete is then poured over the adhesive while it is still tacky. If the concrete cannot be poured before the adhesive sets up or cures, a second application of the adhesive can be made and the concrete can be poured. Some authorities suggest that solvents can be added to these adhesives to help ease their application and allow them to be spread more economically. However, test data indicates that the incorporation of solvents with the adhesives causes the bond strength to be markedly reduced.

Polysulfide Sealants

One other compound, not an epoxy, is normally used in conjunction with epoxy systems for construction and maintenance and is of interest to architects, engineers, and contractors. Polysulfide sealants are rubbery, flexible materials like epoxies with two components that are blended shortly before using. The sealants are normally applied using a caulking or pressure gun. They initially found use for sealing aircraft fuel tanks and pressurized cans. Now large volumes are used for sealing curtain-wall building panels. Pourable modifications of the sealants are now being tested and appear promising for sealing bridge expansion joints, construction joints in swimming pools and other areas where water penetration is a problem.

Although epoxy resin products can be used interchangeably in some cases and most products can be used for many applications, it is necessary to have a few different selected products to fulfill services demanded of these versatile raw materials. For example, although epoxy resin surfacing systems can be used for surfacing, sealing, patching and bonding dry surfaces, they should not be used for bonding to wet surfaces or bonding new concrete to old concrete. The latter applications are best performed by epoxy-polysulfide systems. The epoxy-polysulfide systems in turn, can be used for bonding dry surfaces to each other or for waterproofing surfaces, but their primary use is for bonding wet surfaces.

The laboratories of epoxy suppliers and formulators have developed systems that perform remarkably well under adverse field conditions and efforts are being continued toward the production of more and better epoxy systems. By working with experienced, capable formulators and applicators, the architect, engineer, or contractor can be assured that he will have a reliable epoxy system for successfully and economically performing the job. □□□

DRAINAGE RESERVOIRS SOLVE FLOOD PROBLEM

This article and photographs were contributed by Walter X. Brennan, a technical writer from Grosse Pointe Park, Michigan.

FIVE YEARS ago when developers started a 1,000-home subdivision known as Venetian Village at the edge of Fraser, Mich., neighboring residents predicted its failure because of the drainage problem which had made the property of little value even for farming. Heavy spring rains had frequently forced the closing of an airport on the property. But during the last four years there has been no flooded basement or street in the completely built-up area. With the incorporation of the City of Fraser three years ago, the area was welcomed as part of the city because it added no problem to that community.

The flooding problem was solved by draining the streets into a reservoir and taking the overflow through an existing ditch to a river, five miles across relatively flat land which previously had never been able to handle heavy flood waters.

Venetian Village occupies 210 acres and is drained to a one-acre pond of irregular shape, about 14 feet deep. The reservoir is large enough to contain a 10-year maximum rainfall and is emptied by two automatically controlled pumps. A B/W electrode actuated switch starts a 1,700-gpm Peerless Hydro-Foil pump driven by a 7½-hp synchronous motor when water rises to one foot in depth. Should this fail to start, the second Hydro-Foil pump of 6,000 gpm capacity driven by a 20-hp motor goes into action. Under extreme conditions both pumps can be switched manually. The outfall is a 24-in. diameter concrete pressure pipe from the pumping station one-half mile to the open ditch which takes the water to the river. The end of the outfall is covered with a grating to prevent animals from entering.

Storm sewers are used throughout the area, streets are paved and property graded so all surface water drains to the street. Downspouts from homes drain into the yards and not directly into storm sewers.

Three subdivisions were drained by this plan designed by Munson Associates for the same developers. Since then four neighboring areas have copied the plan. The second subdivision known as Shadow Woods, of 90 acres was similarly drained with lighter equipment. The third installation, made 2 years ago, was West Grove, a 220 acre area which is drained with equipment similar to that for Venetian Village except the pumps were not housed. These pumps and motors are made by Fairbanks-Morse. Recently a shopping center in the area was required to install a reservoir for its parking lot.

This entire area, 15 miles from downtown Detroit, was the closest in open land until the solution of the problem was found. Now it is well built up with homes and prosperous business centers and the most active in the Detroit area real estate development. □□□

● **STORM drainage problems of a development were solved economically by the use of detention reservoirs to reduce flood flow. This is close-up of first reservoir.**

● **WHEN the second reservoir was built, the pumping plant was left in the open. It was found that this aided sales since it gave confidence to potential lot buyers.**

MUNICIPAL SANITATION IN TOKYO

Editor's Note: The government of Metropolitan Tokyo has been concerned with improving sanitary conditions in Tokyo. It requested the City of New York to loan an expert to review Tokyo's sanitation problems and to consult with them on possible solutions. Mr. Liebman was selected and spent three weeks in Tokyo last Fall studying their problems.

HENRY LIEBMAN
Director of Operations,
Department of Sanitation,
The City of New York

● **THIS IS a typical manual street cleaning operation in Tokyo. Women with twig brooms are used for sweeping the streets and hand carts to haul away the sweepings.**

TOKYO has been selected to be the host city for the 1964 Olympic games. In anticipation of a large influx of visitors from all parts of the world, the City of Tokyo is determined to become one of the world's cleanest cities by that time, wiping out any reputation to the contrary. A study of Tokyo's municipal housekeeping practices indicates that there is much to be done in mechanizing and developing equipment for sanitation purposes. Tokyo officials are keenly aware of their sanitary deficiencies and are very anxious to eliminate them.

Leading the fight for improved sanitation are: Hon. Ryotaro Azuma, Governor, and Hon. Kazuo Ota, Vice Governor, of the Tokyo Metropolitan Government, and Mr. Yoshio Kurokawa, Director, Mr. Isao Kawafune, Chief of General Affairs Division, Mr. Masaji Yokota, Chief of Operations Division and Mr. Eisaku Shibaoka, Chief of Facilities Division, all of the Bureau of Public Cleansing, Tokyo Metropolitan Government.

Tokyo is considered the world's largest city. The Tokyo Metropolitan Area consists of a central business and residential core, plus a surrounding suburban zone and some island areas. Tokyo had a total June 1, 1960 population of 9,353,127, of whom 8,014,802 live in the central core. The Public Cleansing Bureau of Tokyo Metropolitan Government is responsible for the cleansing service in the central core (wards) area of approximately 220 square miles, which is divided into 36 cleansing districts. (This may be compared with America's largest city, New York, where 7,781,984 people inhabit 319 square miles.)

The Public Cleansing Bureau is responsible for street cleaning, including snow removal, river sweeping, refuse collection, refuse disposal and night soil collection and disposal. It is divided into three major divisions: 1) General Affairs, which is responsible for management and administration. 2) Operation, which handles the planning and operation of the field activities. 3) Facilities, which builds and manages refuse disposal facilities and equipment. An interesting feature is the laboratory for research on refuse and night soil disposal. To meet their responsibilities, the Bureau has 6,439 employees and an annual budget of approximately $18,700,000.

Street Cleaning

The statistical details of Tokyo streets can be summarized for the 36 public cleansing districts which comprise the central core of Metropolitan Tokyo as follows:

The total pavement length is 9,512,511 meters, with an area of 57,828,532 square meters (sq m). Of this area, 2,815,197 sq m are concrete; 4,957,616 are high class asphalt; 27,305,737 sq m are classed as "simple pavements"; and 17,715,402 sq m are gravel. These are divided into first and second class national highways, main regional roads, common metropolitan roads and ward roads, the latter two groups comprising about 87 percent of the total. There are 3,115 permanent bridges. 1,736 wooden bridges and 21 tunnels. About half of the road length is classed as "improved" and these roads can be grouped by widths as follows: 4.5 to 5.5 meters 25.5 percent; 5.5 to 7.5 meters 35.5 percent; and over 7.5 meters 39 percent. Of the unimproved roads, about 60 percent are less than 3.6 meters wide. Roads impassable by automobiles total 1,351,254 meters.

Street cleaning, except for flushing, is a manual operation and is conducted as one of the unemployment relief measures. Almost all of the work force (approximately 2,350) employed as street sweepers are day laborers and many are women. The Tokyo hand broom is similar to the twig brooms used in European cities. Their machine cleaning fleet, consisting of seven flushers, is used on the main streets which are washed every second or third day. Because of the limited fleet, only about 4 percent of the street mileage is flushed. Approximately 3½ million sq m are swept

daily, while 1.88 million sq m are cleaned once in two days. Thus the total hand cleaned area is about 5.4 million sq m. Each laborer is expected to clean 3,230 sq m per day. The sweepings total approximately 181 tons per day. To transport the sweepings, four hand carts, nine small (about one-ton) trucks and ten large (about four-ton) trucks are used. All of the street sweepings are disposed of in a landfill.

There are no public litter baskets on the streets. Anti-litter regulations are weaker than most statutes in American cities, and enforcement is not vigorous.

There are 132 water courses in Tokyo, of which 32 are swept from one to four times a day. Fifteen vessels and 45 men are assigned to this task and they gather about 50 tons of refuse daily in a rather novel operation.

The floating refuse is collected by large hand nets. It is interesting to note that a similar operation in Venice, Italy, has been mechanized by putting a rotating fixed wire mesh bucket in front of the small boats used for cleaning their canals. The wire bucket can be rotated readily which gives it the appearance of a floating front end loader. I did not see anything similar in Tokyo.

Refuse Collection

The refuse collection service is rendered to approximately 1½ million houses, of which 73 percent are required to separate the refuse. Separate garbage collections are made more than three times a week. The mixed refuse at the other 27 percent of the houses is collected at least once a week. Each householder is required to provide his own receptacle. Commonly, this consists of a cubical concrete container in front of each building. It has a hinged wooden top which the householder lifts to deposit the refuse. In the front of the container there is a sliding wooden gate which is raised by the collector. The collector then reaches into the bin and pulls out the refuse with his hands. The refuse drops into a wicker pan carried by the collector which he, in turn, empties into the collection truck. The collectors also carry hand bells which they ring to announce their presence to the householders. As might be expected, this signal invariably results in some frantic last minute put-outs.

Narrow alleys in much of the city precludes the use of large trucks. In view of this, it is not surprising that refuse collection is made by small sized vehicles. The monthly quantities of refuse collected by municipal forces during the 1959 fiscal year is shown in Table 1. The quantity collected per capita is substantially lower than the quantities we are accustomed to in the United States. Laboratory determinations of the composition of the refuse put out by 100 houses have been made in each of seven branch offices of the Public Cleansing Bureau. The average composition of Tokyo refuse for the 1959 fiscal year is shown in Table 2. The garbage content is substantially higher than currently exists in American cities and reflects the higher usage of non-processed foods in Tokyo.

The municipality services commercial establishments in addition to residential premises. Ordinarily the collection service is free. However, a special charge at the rate of ten yen per ten kilograms is levied when the quantity exceeds

Table 1—Refuse Collected in Central Tokyo

1959 Fiscal Year

Month	Kilograms*
April, 1959	102,117,960
May	113,563,280
June	120,339,830
July	126,059,910
August	125,523,800
September	121,434,200
October	127,337,430
November	107,776,170
December	131,204,080
January, 1960	114,418,400
February	110,652,760
March	120,267,340
Total Annual	1,420,695,160**
Brought to disposal facilities by others	11,309,060
Flood debris	370,860
Spring cleaning put-out	33,071,300

* 1 kilogram equals 2.20 lbs.

** The annual total equals 1,560,000 tons and 1.07 lbs. per capita per calendar day.

Table 2—Average Composition of Household Refuse In Central Tokyo

1959 Fiscal Year

Kind of Refuse	Percentage by Weight
Total Garbage	47.2
Total Trash	52.8
Metal	0.5
Textiles	0.6
Paper	24.0
Strawrope	3.0
Glass and bottle	0.9
Gum	0.6
Bamboo and wood chips	5.7
Cinders	4.0
Fine dust	13.5

● **GOMI BOX into which typical householder places refuse. The box is of concrete or wood. Collector removes contents to a wicker basket which is emptied into a truck.**

Table 3—Refuse Collection & Transfer Trucks Used In Central Tokyo

October 1, 1960

Type of Truck	Number of Trucks Municipal Owned	Hired
Large Dump	54	84
Small Dump	103	173
Small Pack All	20	1
Small Pack Master	26	4
Small Load Packer	14	0
Small Lifting Dump	126	96
Large Open	0	32
Total	343	390

● **MARINE** *transfer station showing the number of small tow boats at the dumping bays. Low bridge in background requires use of small capacity barge shown in center.*

ten kilograms per day and is over two hundred kilograms at one time.

The types of collection vehicles used include rear loading compactors, side loading compactors, and simple covered dump bodies. Large transfer vehicles are also used to reduce hauling costs. Small dump trucks which can be lifted high enough to dump into transfer vehicles are a major component of the city-owned fleet. Hired trucks are also used to supplement the municipal fleet. In Table 3 the composition of their fleet is tallied.

Refuse Disposal

Space is at a premium in densely populated Tokyo. The reclamation of land is a continuing practice in Japan. It is thus not surprising that refuse disposal in landfills is popular and accounts for 82 percent of the refuse. Incineration disposes of approximately 12 percent. Minor disposal methods include feeding garbage to swine (3 percent) and composting (3 percent). As with any large city, conveniently located landfill sites sooner or later become difficult to find within a reasonable hauling distance. There is a growing interest in incineration to improve sanitary standards and to reduce the ton-miles hauled. Five incinerators are operating today and eight more are planned in their future construction program.

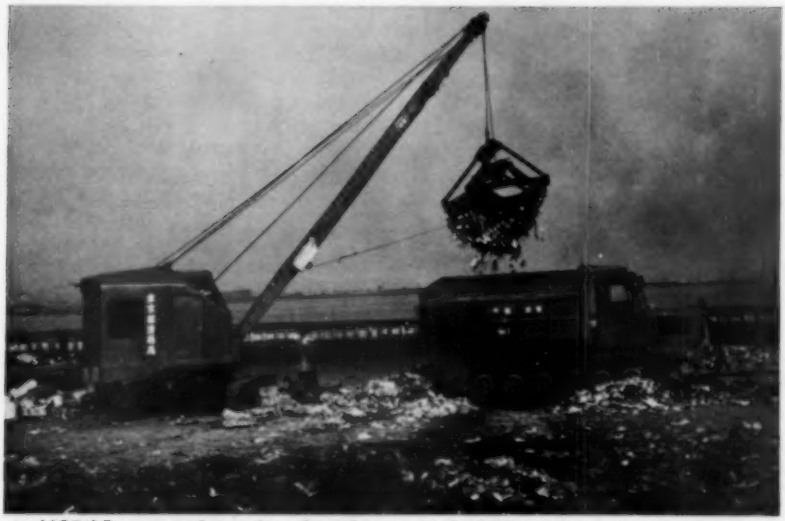
Those now in operation were built between 1924 and 1958. The five older units have been renovated but have a total capacity of only 238.5 tons in 10 hrs. The latest unit, built in 1958, has five furnaces and an 8-hr. capacity of 187.5 tons. The 8 new units planned will be 6-furnace units with an 8-hr. capacity of 200 tons each. These will go into service gradually between 1962 and 1967. The five existing units received an average of 584.2 tons of refuse per day in 1959, with 84.25 tons of residue.

Three active landfills absorb most of the refuse from the central core of Tokyo. The Hachigo-chi landfill has been in operation since 1927 and is approaching completion. It receives approximately 780 truck loads (1,510 tons) a day. In the pre-World War II period, the refuse was covered with masses of flies. Today, the refuse is covered with coal waste and other materials in a cover ratio of one to ten. Nearby, is the companion fill of Yumenoshima (English translation: Dream Islet). This was originally intended as an airport during World War II but was never completed. Since it is an island, hauling must be by boat. The equipment, manpower and vessels assigned to this landfill is as follows:

Fixed cranes, one owned and 6 hired; clamshells on crawler treads, 2 owned; bulldozers 1 owned and 7 hired; front-end loader, 1 owned; dump carts 7 owned and 12 hired; insecticide sprayers, 3 owned; and steel mats 315 owned. There are 87 bureau employees and 49 others are hired as needed. The marine fleet consists of 12 tugs, 7 of them hired, 7 self-propelled vessels, 3 of them hired; and 98 barges, 56 of them hired. Capacity of the Bureau-owned barges averages about 17 tons each; the hired barges average about 70 tons each.

As with the trucks, the small capacity of their vessels is one of the features which struck me on my inspection of this operation. (A New

● **STREET** *transfer station showing small lifting dump truck emptying refuse into larger transfer truck for haul to disposal point. Refure averages 1.07 lbs/cap/day.*



● **MOBILE crane takes refuse from barges at dockside and transfers it to a large tracked vehicle which takes it to the active face of the landfill for final disposal.**

York City refuse barge typically holds from 500 to 900 tons of refuse.) The third fill, Tokumaru-honcho, receives about 165 tons daily and is the smallest operation.

The two composting facilities take refuse as well as night soil. There has been little revenue obtained from the compost produced and I understand that there has even been difficulty in giving it away. Only 1,888 tons of compost were produced in 1959.

Night Soil

In Tokyo's central core, only about 20 percent of the area is serviced by a sewerage system. Thus, about 80 percent requires some means of night soil disposal to prevent disease. Fifty-six large and 581 smaller vacuum trucks are used to suck up the sewage from each home. To reduce the hauling costs, three large transporting vacuum vehicles are used to receive night soil from smaller vehicles. This mechanized operation has replaced the previously used dipper and pail to a large extent. It is anticipated that, in the near future, night soil collections will be completely mechanized. About 41 percent of the night soil is taken to marine transfer stations where it is transferred to vessels for sea disposal. Approximately 218 vessels are used for dumping at sea. In addition, 20 digestion tanks convert the night soil into an organic manure. Miscellaneous disposal methods for night soil include 19 percent disposed of to farmers as fertilizer, 2 percent put into the sewerage system, and 1 percent transferred to the composting operation. This municipal service is supported by a charge of 15 yen per 36 liters, except for needy households which are not charged.

Since the extension of the sewerage system will take years to complete, the municipality is urging the installation of a flush lavatory with a septic tank for each household. In order to speed up proper sewage disposal, the Metropolitan Government is also offering subsidies to those householders who install the septic tanks. In the area where the sewerage system exists, about 12 percent of the homes are still not connected. Here too, the Metropolitan Government is extending subsidies to cooperating property owners.

Recommendations

After reviewing Tokyo's present operations, I made a series of recommendations to assist their sanitary modernization program. Some of my major recommendations were:

A. Street Cleaning: 1) Street cleaning of all major arteries, roadways, bus routes and business areas, which is now divided between the wards and the Metropolitan Government, should be concentrated in the Metropolitan Government to facilitate mechanization. 2) Major reliance should be upon machine cleaning with supplementary cleaning by hand. 3) Litter baskets should be installed on the main streets and other pedestrian concentration areas.

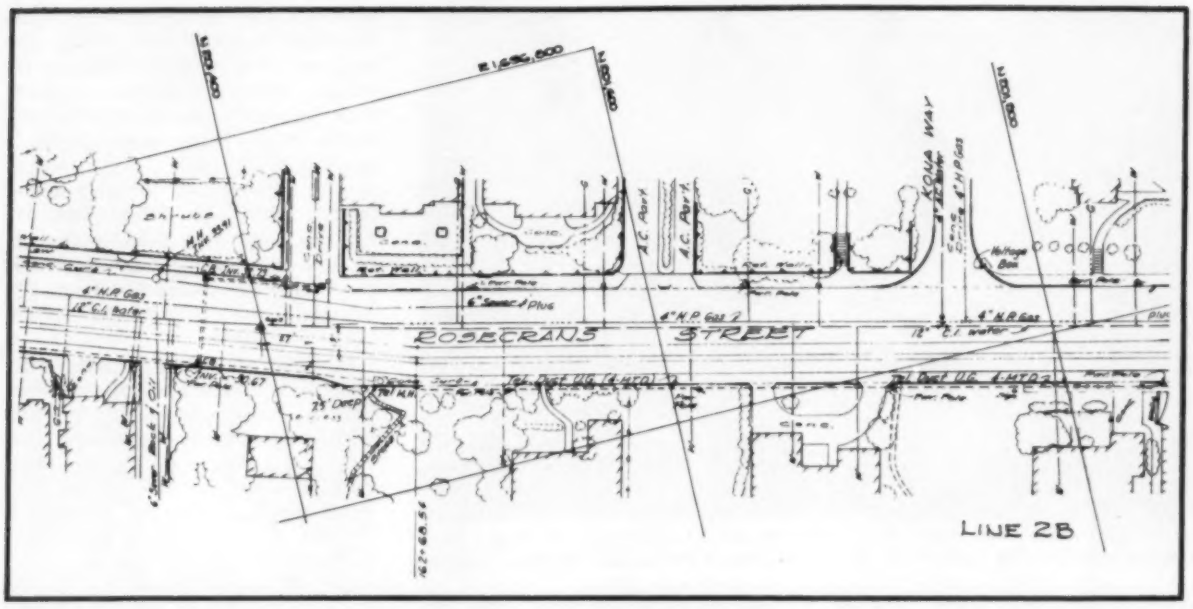
B. Refuse Collection: 1) The householders' concrete "gomi" boxes should be eliminated since they are unsightly and messy. 2) Separate garbage and rubbish collections should be eliminated since they are costly and practically all refuse goes to the same disposal locations. 3) All householders should be required to have containers with tight fitting lids. 4) All open collection vehicles should be replaced with totally enclosed trucks of the compactor type. 5) Transfer vehicles should have larger capacities.

C. Refuse Disposal: 1) All landfills should be converted to completely engineered sanitary fills with proper grades, drainage, insect and rodent control, fire prevention, adequate cover, screening, roads and other features. 2) Marine transfer stations should be totally enclosed structures and be relocated to points along the rivers where larger barges could be used. Barges of greater capacity should be used. 3) At the marine unloading plant, a single large crane with a ten cubic yard bucket should be used in place of the many small cranes. 4) The marine fill should be operated as an engineering project and as a complete sanitary fill to prevent fires and other nuisances. 5) Future incinerators should be of the continuous feed, mechanically stoked, continuous residue removal type with provision for air pollution abatement. 6) Incinerator locations should be based on economic analysis to attain the most economical and efficient system as well as locations which will meet with public acceptance. 7) Designs should include provisions for auxiliary fuel to insure combustion under difficult charging conditions. 8) The furnaces should be designed to take mixed material and to operate on a 3-shift per day basis, with refractory walls and arches designed for high temperatures.

D. Public Relations: 1) A public relations program (similar to New York City's program) to enlist broad based citizens' support for a cleaner Tokyo should be developed.

E. Enforcement: 1) Establish a sanitary patrolmen corps to enforce sanitary regulations. 2) Modify existing legal procedures to simplify the issuance of summonses.

F. Miscellaneous: 1) Adequate garages and housing for personnel and equipment should be provided. 2) Additional engineers should be employed in the operations division. □ □ □



● **EXAMPLE of final planimetric map developed by photographic compilation from aerial photographs and field surveys.**

Economical Survey Method for Sewer Design

LEIGHTON S. HAMMOND
Chief of Surveys,
Holmes & Narver, Inc.,
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TO PROVIDE construction drawings and specifications for expanding its sewerage facilities, San Diego, Calif., engaged Holmes & Narver-Montgomery, a joint venture. Included was the responsibility for obtaining all field information essential to design requirements. In addition to other features, this project includes 23 miles of interceptor sewer with sizes up to 126-in. diameter. The interception route crosses the business district of San Diego along heavily traveled arteries where progress by conventional ground surveys would be hampered by heavy traffic.

Under conditions such as these, proper knowledge of survey requirements, with careful planning, can produce significant cost savings in the surveys and in the subsequent design stages as well. The ability to coordinate needs, assess the advantages and choose between ground party and aerial mapping and/or combinations of these methods, requires a comprehensive knowledge of the engineering aspects of the project. This can be realized only when surveys are a part of the entire engineering and planning authority.

Surveys for the design of interceptor or trunk sewers include the requirement to map a strip of varying width along a proposed route. The design engineers need to know the existence and location of structures and utilities which may influence design criteria. For the most economical mapping, it is essential that survey methods be such that results are obtained which are consistent with project design requirements without over-emphasis on features not critical for design.

The relationship of survey responsibility to design responsibility may be stated as follows: 1) Surveys—establish and mark a permanent control traverse for aerial photography and furnish the necessary prints; design—determine preliminary alinement by use of the photographs and prepare sketches to be included in field completion. 2) Survey—prepare planimetric strip maps at design scale to cover the required area; design—work up the strip maps to indicate required additional field information, including critical dimensions, utilities, etc. 3) Survey—complete field surveys and add data to strip maps; design—determine final alinement, with additional needed survey data. 4) Survey — establish alinement from control traverse and provide centerline profile; design—plot profile and complete final drafting.

The routing of a sewer or storm drain, or the addition of a building to an installation, may not be determined as much by the variation in ground elevation, as by the horizontal relation to existing facilities. The conventional ground survey methods of recording the locations of planimetric features in field books to be plotted in the office, or by plane table methods, are not compatible with the crash programs of today. The time required to obtain the field information required for design of a complex project, or a relatively simple one, can be greatly expedited by aerial mapping techniques.

In this project, the routing of the interceptor sewer was determined by field reconnaissance in conjunction with the use of available topographic maps, most of which had five-foot contours. "As-built" drawings were available for only a small portion of the route traveled by the sewer, and mapping of the entire route was necessary. On the day authority was received to proceed

with design, the designers needed survey information. In order to obtain the required field information in the shortest possible time, aerial mapping techniques were employed. Negotiations were completed with competent local firms to perform ground surveys; aerial mapping was performed by a firm experienced in this technique.

Photogrammetric Method Used

The recovery of street centerlines throughout most of the San Diego area, and their use for survey control, would have required extensive field work and delayed the mapping program. Therefore, a control traverse was run following the proposed route, and the City Engineer's tie points and property monuments were related to this traverse.

This method permitted longer tangents and shortened the time required to complete the traverses. To satisfy the requirements for aerial photography, the traverse points were set at intervals not to exceed 800 feet. The traverses were closed on United States Coast and Geodetic Survey primary triangulation monuments, or on California Division of Highways monuments, which had been related to this primary control. Because of the distances between these primary control monuments, and to maintain constant accuracy, it was specified that the traverse closures should be within a tolerance of 1:10,000. After adjustment of the traverses, plane coordinates were computed for all traverse points, based on the California plane coordinate system.

As the relation of the sewer to ground surface was determined primarily by the gradient between critical points, an accurate ground profile was not required for preliminary design. With the exception of a few areas, the available topographic maps with five-foot contours satisfied these design requirements.

Primary Data From the Field

All traverse points were premarked with a white circle for picture pointing, and a strip of aerial photography was obtained which was centered over the control traverse. This photography was at a flight scale of 1:2400, providing contact prints with excellent detail which were immediately available to the design section. Strip mosaics were also prepared.

From a study of these prints refinements were made in the preliminary alignment, and mapping widths were established. The average width of the mapping was 200 feet, with additional coverage where alternate alignment was being considered. This coverage was sufficient to show the property improvements along the line and to indicate the density of existing utilities. This was important in determining the comparative costs of alternate locations for the sewer alinement.

Compilation of Field Data

The planimetric maps were compiled on 23 in. x 36 in. sheets of transparent Cronoflex film, at a scale of 1 in. = 40 ft., and with several strips of mapping on a sheet. This compilation scale was the same scale as that chosen for the design drawings. This permitted using prints of the mapping sheets for work sheets, and then tracing the detail on the final design sheets. All planimetric features which could be identified from the photography were plotted in pencil. As the detail was to be traced, the additional expense of inked work was not necessary. The accuracy of the plotting was generally within one foot of true position, which satisfied all but the most critical conditions. The completeness of this method of mapping was emphasized by the small amount of planimetric detail added by the field completion survey. The strip maps were delivered to the design section, sheet by sheet as completed. Considerable progress had been made on alinement studies by the time the last sheet of the section of the route was delivered. The quality and adequate coverage of this type of mapping was indicated by the limited use made of the strip mosaics after the mapping was available. The plane coordinate grid and traverse monuments were indicated on the sheets but, to avoid unnecessary congestion, the traverse data was not shown.

Underground utility research was carried on concurrently with the mapping program. The indicated positions of these utilities were plotted on prints of the strip maps for field checking. Some of this plotting was accomplished directly from the records at the office of the utility companies, avoiding the necessity of reproducing these records for office use. Notes were added regarding critical dimensions, descriptions of specific structures, etc., to be obtained, which were essential to design. These sheets were then sent to the field for the field completion surveys. The proper approach to the field completion is an important detail in planimetric mapping. It is essential that the survey methods be such that results are obtained consistent with project design, but without over-emphasis on features not critical to design. Critical dimensions must be shown, but other less important features may be plotted to scale. This phase included the search for and plotting of features not identified from the photographs. These were generally small items such as manholes, valve boxes, etc., and working with the prints, considerable progress could be made in a day. Types of pavement were recorded together with other information which would aid the designer. The major item of the field completion surveys was the locating of underground utili-

● **AERIAL photographs were used to compile the planimetric map of area enclosed within the white lines. Underground utilities were plotted by a field completion survey.**

● **PLANIMETRIC mapping machine similar to the one shown here was used in developing the survey information required for design of the San Diego sewerage project.**

ties. Invert elevations were obtained and locations were dimensioned where critical; other utilities were described and plotted to scale.

Field Completion Data

The field completion sheets were returned to the office as each sheet was finished, and this additional data was added to the original mapping sheets. Final alinement was established and the relation of the alinement to the control traverse determined. An electronic calculating service was used in these computations and resulted in a considerable saving in time. The adopted alinement was established by offsets from the control traverse, and a centerline profile obtained. Existing bench marks were considered satisfactory for the purpose of the profile, and precise bench marks were to be established immediately prior to construction.

Advantages of Techniques

The use of planimetric mapping to obtain the field information for design of this project had several advantages over ground survey methods. Some of these advantages are:

1) Photo coverage was available early for increments of the route. This furnished the designers with information on the density of existing improvements for more than a city block either side of the proposed route and permitted the designer to study complexities of the route before fixing the mapping coverage. Had alternate routes been under consideration, this photographic coverage could have been obtained at low cost by inclusion in the scope of the mapping flight.

2) The mapping coverage was sufficient to indicate any conflict with existing improvements, and to allow for refinement in the alinement. The costs of providing as much information, and as fast, entirely by ground surveys, would have been excessive.

3) The mapping was to design scale and became background sheets for the addition of all field design data. The plotting of data recorded in field books was held to a minimum and was mostly in regard to underground utilities. The final construction drawings were traced directly from these sheets.

4) The flow of information to the designer was consistent with progressive design studies: from photography to basic planimetric mapping, to the addition of critical field data.

5) There was a substantial saving in time and cost over ground methods, particularly as most of the ground surveys were performed in congested traffic areas.

Comparison With Other Methods

Definitive comparison of costs between the aerial mapping approach and ground survey methods is not practical, as no two areas present the same problems. By either method, a control traverse must be run or existing control recovered. Where street centerlines are well monumented and adjusted against control networks, the cost and the time on this phase can be reduced considerably. The length of the route to be surveyed, or the width of the mapping strip and detail required by the designers, may be determining factors, but the convenience of having the mapping furnished at design scale is well worth considering.

Acknowledgments

The following participated in the design work for the expansion of the San Diego Sewerage System Expansion program, in addition to the joint venture of Holmes & Narver-Montgomery: Surveys: Daniels, Brown & Hall and Freeland, Evenson, Christenson & Boas of San Diego and La Mesa Engineering Services of La Mesa. Photogrammetric mapping, Pafford Associates, Los Angeles. □□□

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Grass for Freeway Roadsides

The Michigan Highway Department's Maintenance Division is using 31,000 pounds of grass seed and more than 500,000 pounds of fertilizer on right-of-way adjoining newly completed state freeways. According to Ed Eckert, Chief Forester of the Highway Department, work by the Highway Department represents only 10 to 20 percent of the total landscaping and seeding being done on state roadsides during the 1961 spring season. Highway contractors are responsible for the remaining work. It is estimated that the cost of landscaping and seeding being done ranges between $125 and $175 an acre, depending on the amount of landscaping required.

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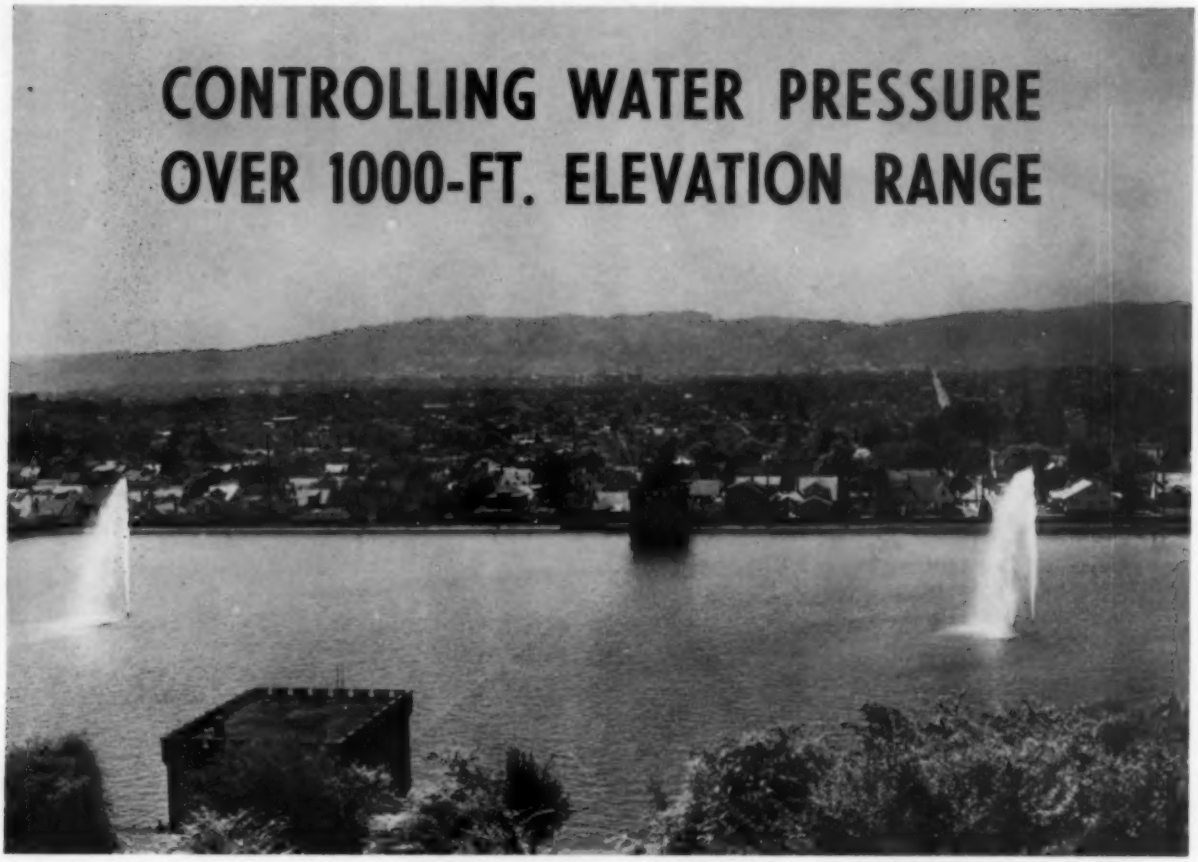
Service Records of Utilities

In the 1960 report of the Hastings, Nebraska, Utilities, it is noted that the water utility has been successfully operated by the city for 74 years, the sewer utility for 70 years, the electric for 59 years and the gas for 18 years.

CONTROLLING WATER PRESSURE OVER 1000-FT. ELEVATION RANGE



● VIEW FROM Mt. Tabor overlooking Reservoir No. 6. High area in the background is where most of the regulators are used.

H. KENNETH ANDERSON
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Bureau of Water,
Portland, Oregon

PORTLAND, OREGON, prides itself as being a well "regulated" city! Specific reference here is to the proper regulation of water pressures to Portland's varied users.

Due to the local topography, it is imperative to install pressure regulators in many sections of the city to avoid excessive and damaging water pressures. Research and experience have shown that through automatic pressure regulating valves, water pressure can be controlled most effectively and with the least cost to the water user. An alternate type of water pressure control would be to establish a complex step-down reservoir system, a costly operation and one with many additional problems and costs.

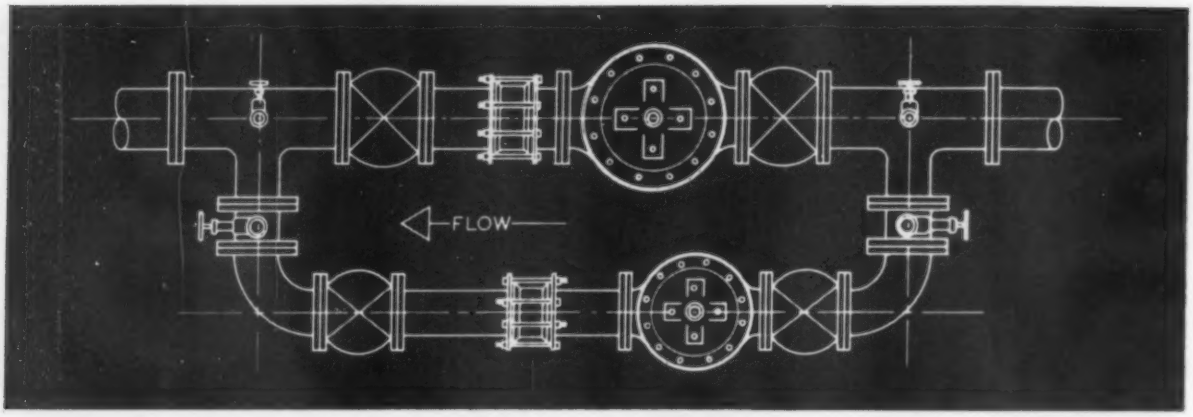
Portland's elevation range is from a high of 1,044 feet at Council Crest Park to a low of 24 feet above sea level. It requires 217 "regulators," placed in 105 installations to control the city's varying water pressures. These vary in size from ¾ inch to 24 inches. This number of regulators represents a very small investment to maintain relatively uniform and safe water pressures throughout a city the size of Portland with a population of nearly 400,000.

The range in pressure of the city's regulators is tailored to the needs of the area served; however, it is a matter of general practice to provide customers in those areas served by regulators with a range of pressures from 50 to 100 psi.

About 80 percent of Portland's pressure regulators are located west of the Willamette River which divides the city roughly in half. There are 13 principal storage sites at eight elevations on the west side. These elevations are 229, 299, 446, 643, 737, 865, 1048 and 1144 feet, respectively. Between these elevations and in locations not readily accessible to one of the storage zones listed, the regulators and supplementary storage tanks perform their function. It has sometimes been necessary to feed through regulators from a higher storage level to a lower elevation even though this lower area could be served adequately from a storage site in the same pressure zone. This generally results from a study of the economics involved in which the costs of the installation and maintenance of main extensions from the reservoir normally supplying that elevation are weighed against the additional pumping and regulator costs of supplying the area from a higher but closer storage site.

The east side of the Willamette River is comparatively flat and is served almost entirely by gravity from the basic storage elevation of 411 feet. There is some regulation between pressure districts where economy does not justify running large parallel mains to adjoining districts from the centrally located principal storage site on Mt. Tabor.

A pressure reducing valve is a self-contained automatic regulating device for maintaining a specified uniform water pressure lower than that of the higher source pressure. There are several types of pressure reducing and pressure sustaining devices, but nearly all types oper-



● **TYPICAL pressure reducing valve layout, Variations of more than 1,000 ft. in elevation require many such installations.**

ate without the use of an external power source. One of the most widely used and most effective automatic regulating valves in Portland's system is the pilot operated diaphragm type. In this, the main valve is a single seated diaphragm operated globe type valve; the reducing pilot control is sensitive to slight pressure changes and causes flow through a restricting device to vary as pressure changes. The flow through the restriction controls the hydraulic pressure on the cover chamber of the main valve by letting water into or out of the cover chamber, thus controlling the opening and closing of the valve and regulation of the pressure.

For example, if downstream pressure begins to increase as water use diminishes, the pilot control automatically senses that pressure increase and begins to close. The line pressure is diverted into the cover chamber of the main valve, regulating the pressure at the outlet. If downstream demand increases, the pilot opens to supply the increased demand. Thus a constant pressure is maintained in the system.

Adjustments

There are several ways in which the valve may be adjusted. The pilot may be set to maintain a given downstream pressure. Opening and closing speeds of the main valve are accomplished by a combination of restricting devices. The basic valve with additional controls is capable of many combined functions such as 1) pressure reducing and check valve combinations; 2) pressure reducing and pressure sustaining; and 3) combination pressure reducing and rate of flow control.

The regulators are generally installed in pairs but sometimes in threes where there is a wide variation in flow. Each regulator installed in parallel opens at a slightly varying pressure to prevent chatter on the valves. The smaller regulator (which in most cases is 2-in.) opens at a slightly higher pressure on the downstream side of the installation and the larger regulators open in sequence if the pressure continues to drop. The regulators close in reverse order, with the smaller closing last.

Any single regulator can be taken out of service for repairs or adjustment while its counterpart continues to function. The regulators are normally installed in subsurface vaults with ready access for maintenance. □□□

Sidewalk Snow Removal Requirements and Procedures

TWO QUESTIONS regarding snow removal were asked of cities by the editors of Public Works in a recent questionnaire. The first installment of returns numbered 1250, representing 22 percent of the questionnaires mailed.

The first question was: Does the city remove snow from sidewalks in the business area? The result was as follows: 240 cities reported they did remove snow from sidewalks in the business area and 567 said they did not. These returns may be subject to slight modification by area considerations. From Arkansas, where there are only rare snow problems, two cities reported rather naturally, that snow was not removed from business area sidewalks; a similar report came from one city in Georgia; but one South Carolina city said it did remove snow from sidewalks.

In New England, the practice is quite overwhelmingly in favor of clearing snow from business area sidewalks by municipal forces. Connecticut was the single exception with 8 cities reporting removal and 16 stating the city did not remove. The total for the six New England states was 76 for removal by city forces and 47 against.

In the North Atlantic States—New York, New Jersey and Pennsylvania—the tabulation showed 49 cities removing snow from business area sidewalks and 128 not providing such service. In the East North Central area—Illinois, Indiana, Wisconsin, Michigan and Ohio—66 cities reported municipal clearing of business area sidewalks while 162 said such service was not provided. In the group composing Minnesota, North and South Dakota and Iowa, the score was 12 for municipal removal and 53 against.

A second question was: If property owners are required to clear walks, how long after snow stops before summonses are served? A wide scattering of answers was received. Grouping on the nearest practicable basis showed that 29 cities allowed approximately 48 hours; 161 cities allowed 24 hours; 50 cities allowed 12 hours; 50 cities allowed 8 hours or less; and 40 cities gave a variety of answers. Among these were such wordings as a "reasonable" or "practical" length of time; "by 8 am of the following day"—or some other specific hour, as noon. There were also some other elastic terms reported, as "promptly" or "immediately."

ELECTRIFICATION of a Sewage Pumping Station

C. E. KEEFER

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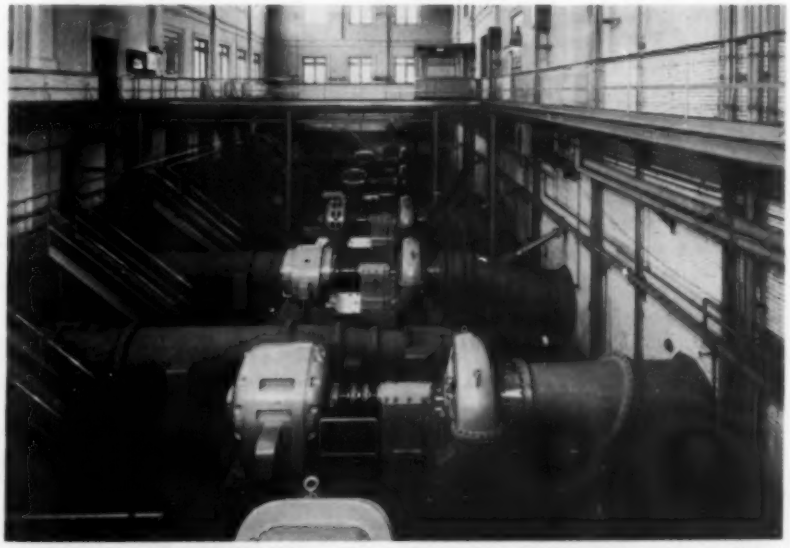
IN January, 1912, the City of Baltimore put in service its Eastern Avenue sewage pumping station. This station, which was built at a cost of $1,085,000 was provided with 3 triple-expansion pumps, driven by Corliss steam engines, each of which was capable of delivering 27.5 mgd against a total head of 72 ft. through two 42-in. force mains 5,-305 ft. long. These pumps remained in service until November, 1959, when they were removed and replaced by motor-driven centrifugal pumps. The electrification and the modernization of the station, which has cost $1,385,548 exclusive of engineering costs, was begun in 1953 and completed in 1961.

Between 1911 and 1953 a few additions were made to the pumping station to keep pace with the increase in sewage flow. The three steam boilers in the station, each of which had a capacity of 266 hp, were supplemented in 1919 by a fourth boiler with a capacity of 400 hp and in 1929 (1) a steam-turbine-driven, double-suction, horizontal centrifugal pump with a capacity of 30 mgd when operating against a total dynamic head of 70 ft. was provided. Shortly thereafter a 36-in. by-pass was installed to the harbor, which is immediately adjacent to the station. This by-pass was considered necessary, because the hydraulic grade of the sewage in the suction well of the station was several feet below mean low tide; and if there should be an excessive sewage flow or if one or both of the two 42-in. cast-iron force mains from the station should fail, the sewage could be pumped direct to the harbor. Subsequent experience indicated that this by-pass was most essential, as it was necessary to use it on a number of occasions.

Prior to installing the 30-mgd pump, cost studies indicated that the most economical procedure to follow to increase the capacity of the station would be to provide steam-turbine-driven centrifugal pumps. However, studies made 25 years later indicated that electric-motor-driven centrifugal pumps would be the most economical type of units to install. In this 25-year interim the cost of coal, supplies and labor had more than doubled and electric motors and centrifugal pumps with higher efficiencies were available and the cost of electric power had increased only 6 percent.

The improvements undertaken from 1953 to 1960 were made in three steps and involved letting four major contracts. These were as follows: 1) Furnishing and installing a Diesel-driven 175-mgd mixed-flow pump; total dynamic head 16.5 ft. 2) Furnishing and installing a 40-mgd, motor-operated centrifugal pump and high-tension electrical equipment; TDH 84 ft. 3) Furnishing four motor-operated centrifugal pumps with capacities varying from 25 to 40 mgd; TDH 77 to 84 ft. 4)

● **PUMP ROOM of the Eastern Ave. sewage pumping station as it apeared in 1929. At rear is one of the station's three triple-expansion steam-driven 27.5 mgd pumps.**



● **AFTER electrification the same pump room houses five motor driven centrifugal sewage pumps varying in capacity from 25 to 40 mgd each with TDH of 77 to 84 feet.**

Removing the 3 existing reciprocating pumps from the station and installing the four new pumps.

Diesel-Driven 175-MGD Mixed-Flow Pump

The purpose of installing the diesel-driven mixed-flow pump was to prevent flooding the pumping station and the adjacent low-lying sections of the city in case of a failure of electric power after the use of the steam-driven pumps was discontinued. This pump has a capacity of 175 mgd when operating against a total dynamic head of 16.5 ft. This capacity was considered necessary even though the average flows in the past have rarely exceeded 45 mgd with normal peak flows of 60-65 mgd. During one very severe rainy period in 1933 a peak flow of 157 mgd had to be handled. The pump, which operates at a maximum speed of 303 rpm, is a horizontal unit with 60 and 54-in. suction and discharge connections respectively. The pump is driven by an 800-hp quad diesel engine, which can operate at variable speeds up to 1,800 rpm. Water from the harbor or from the city water mains is used to cool the engine. A 4-in. duplex strainer is provided in the cooling water pipe to the engine to remove any solids that may be present. The sewage is pumped through a conduit for a distance of 83 feet into the harbor. Since it is important to operate the pump at frequent intervals to keep it in good running condition and it was not desirable to pump sewage into the harbor during these tests, a 24-in. cast-iron by-pass was provided so that the discharge from the pump could flow back into the suction well of the station. This pumping unit was put in service in 1957 and has been an invaluable addition to the station.

New Centrifugal Pumps

The pumping station serves much of the business and mercantile section of the city, particularly in the low-lying areas relatively near the harbor. As much of this area is fully developed, it is anticipated that the sewage flow in the future will not be materially greater er than at present. During the 20-year period from 1940 to 1959, inclusive, the flow averaged a minimum of 32.31 mgd in 1959 and a maximum of 45.22 mgd in 1948. The pumping equipment will have a maximum capacity of 97 mgd with one of the largest units out of service. At this flow it is estimated that the total dynamic head will be 99 ft. when pumping through the two existing 42-in. cast-iron force mains. One 25, one 30, one 35 and two 40-mgd pumps have been provided.

The pumps are of the horizontal single-suction type. Each pump casing is made in two sections and is split horizontally along the center line of the pump shaft. This feature, although almost invariably required in centrifugal pumps for handling water, is being specified less and less for sewage pumps. The chief reason for requiring centrifugal sewage pumps to conform to such a design is to facilitate dismantling them. It is much more necessary that a centrifugal pump handling sewage have this feature than one handling water, as sewage pumps are subjected to more severe service, are more likely to become clogged and have to be opened more frequently. The cast iron in the pump casings and the impellers was required to contain 2.0 percent nickel and 0.2 percent chromium for the purpose of producing a stronger and more dense metal. The suction eye of each casing was provided with a type 420 stainless-steel wearing ring, which was heat treated to give a Brinell hardness of approximately 475. A similar casing wearing ring was also provided in the casing on the shaft side of each impeller. Type 410 stainless steel wearing rings, nitrided to give a Brinell hardness of approximately 600 were furnished on the suction inlet and the shaft side of each impeller. Within the suction eye of each casing there is a renewable, flat, circular stainless-steel plate fitted into a machined recess in the casing and provided with means to guard against rotation. A similar plate is also provided in each casing adjacent to the shaft side of each impeller. These plates prevent sewage, which flows between the wearing rings, eroding the pump casings. All of the impellers were required to pass 8-in. spheres. The speeds of the pumps range from 494 to 500 rpm. The motors used to operate the pumps varied from 450 to 700 hp and were of the 40°, three-phase, 60-cycle, 2,300-volt, squirrel-cage type. Split-sleeve, babbitt-lined-type bearings are provided on both the motors and the pumps.

The sewage is pumped from a suction well against a lift of about 3 to 8 ft. Each pump connects with its individual 42-in. pipe and discharges either into one or both of the existing 42-in. cast-iron force mains. Immediately before each pipe passes through the exterior wall of the pumping station, there is a 24-in. motor-operated cone valve for shutting off the flow. The piping arrangement is such that the sewage can be bypassed to the harbor if it should become necessary to put one or both of the force mains out of service or if they should fail. All straight pipe and fittings on the discharge side of the pumps are Class "B." All of the suction and discharge piping which connect with the 5 sewage pumps together with the bodies of the cone valves in these pipes in the station are insulated with granulated cork, ⅜-in. thick, to prevent the formation of condensation.

Electric Equipment

To insure continuity of electric service, two 13,200-volt power lines enter the station from separate underground ducts and substations of the local power company. The power lines terminate in a main primary metalclad switchgear. From there power is fed to two separate transformers and then to a secondary switchgear. The primary switchgear, which is designed for 13,200-volt service contains four sections. The two middle sections, which connect with the incoming power lines, are each provided with a circuit-breaker control switch and a triple-

Manufacturers of Equipment

Centrifugal pumps	DeLaval Steam Turbine Co.
Mixed flow pump	Worthington Corporation
Electric motors, 450 to 700 hp.	General Electric Co. & Electric Machinery Mfg. Co.
Transformers & switchgear	General Electric Co.
Cone Valves	S. Morgan Smith Co.
Venturi meter equipment	B-I-F Industries
Cast iron pipe	U. S. Cast Iron Pipe & Foundry Co.
Emergency generator equipment	D. W. Onan & Sons, Inc.
Diesel engine, 800 hp.	General Motors Corporation

● BOILER room, once housing four steam boilers, now has two plant heating units.

pole, single-throw, 13,800-volt, 1,-200-ampere circuit breaker, which is operated by a 125-volt, direct-current solenoid. These two middle sections also contain potheads for terminating the cables of the power company, current transformers, ammeters and other equipment. The two end sections of the primary switchgear serve to mount the metering equipment of the power company.

The primary switchgear connects with two ventilated, dry-type, self-cooled, 3-phase, 2,500-kva transformers, which reduce the potential from 13,200 to 2,400 volts. Each transformer is provided with an alarm, which rings if the temperature of the air in the transformer reaches a predetermined amount.

The secondary side of the two transformers connects with the secondary switchgear and motor-control cubicles by means of the two 2,400-volt circuits. The secondary switchgear consists of 12 metal-clad units. Two of these contain 1,200-ampere circuit breakers, which are in the above-mentioned circuits from the transformers. Another unit contains an automatic - manual transfer switch and a 1,200-ampere bus-tie circuit breaker. The equipment is designed so that if there is a failure of voltage in the secondary of one of the transformers, the circuit breaker in this circuit is opened and the bus-tie circuit breaker closes. Means are also provided to prevent the tie-circuit from closing if the breaker in the secondary circuit of the transformer opens because of an overload or faulty conditions. There is no provision for automatically closing the transformer secondary circuit breaker upon the return of voltage to the secondary of the transformer. Two of the switchboard units consist of cubicles for controlling three of the motor control cubicles at one end of the switchgear and two at the other end, and 5 of the switchboard units contain 1,200-ampere circuit breakers for controlling the 5 motor-operated sewage pumps.

A 60-cell, 125-volt storage battery has been provided to furnish direct current to close and trip the switchgear circuit breakers, to light the breaker indicating lamps, to shut down the sewage pumps when the sewage in the suction-well reaches a predetermined low level and to operate the alarm system, the circuit of which is normally closed.

An all-steel control panel, which is accessible from the front and the rear, is provided in the south wall of the pump room. This panel contains alarm bells, an electric clock, a Venturi meter totalizer-indicator-recorder, a sewage-level recorder, ammeters and pushbutton stations for operating each of the sewage pumps together with pushbuttons, lights and relays associated with the alarm system.

Auxiliary Equipment

An automatically operated, gasoline-engine-driven, 62.5-kva, 480-volt, 60-cycle, 3-phase generator has been provided to light the station and to operate some of the more important small motors in case of a power failure. This emergency unit is provided with a 110-gal. steel, gasoline storage tank, which is encased in concrete in the ground outside of the station.

Since the maximum elevation of the sewage in the suction well of the pumping station is 3.0 ft. below the center line of the sewage pumps, two displacement - type vacuum pumps, each with a capacity of 62 cu. ft. of air per minute, were provided for priming purposes. One of the vacuum pumps serves as a spare. Both vacuum pumps are connected through a 2-in. steel pipe with a cylindrical vacuum tank 72-in. long by 30 in. in diameter. The center line of the vacuum tank has been placed 51.5 ft. above the maximum elevation of the sewage in the suction well. Locating the tank at such a great distance above the sewage was considered necessary because at two existing sewage pumping stations where sewage pumps are primed in a similar manner by vacuum pumps, sewage solids are lifted well above 34 ft., the elevation at which a perfect vacuum is produced. Two mercury vacuum switches have been installed to start and stop the vacuum pumps. These pumps keep each sewage pump primed at all times. There are also two mercury vacuum swtiches attached to each of the 6-in. vertical vacuum pipes which connect with the suction-piping to each sewage pump. One of these switches sounds an alarm when the vacuum drops to the equivalent of 13 ft. of water, and the other switch shuts down the sewage pump when the vacuum pressure drops to the equivalent of 10 ft. of water.

The pump room floor is drained by sloping it towards a narrow trough at the walls. This trough drains to a pit, which contains a motor-driven sump pump with a capacity of 200 gpm when operating against a total dynamic head of 15 ft. The pump is capable of passing 1½-in. spheres. Two floats are provided in the sump for operating the pump and for sounding an alarm if the water in the sump should rise above a predetermined level.

The station is heated by two oil-fired steam boilers, each with an approximate heating surface of 715 sq. ft. The boilers burn No. 6 fuel oil and operate at an approximate pressure of 5 psi. Two tanks, each with a capacity of 6,000 gal., have been provided outdoors in a concrete vault above the ground for the storage of oil. The small rooms in the station are heated by radiators and the large ones by propeller, fan-type unit heaters.

The two existing 42 x 21-in. Venturi meter tubes, which are in the

(*Please turn to page* 208)

SALT AND EQUIPMENT
STORED UNDER ONE ROOF

BY COMPLETELY sealing off part of a new building, built initially to house highway and county maintenance equipment, Calumet County (Wisconsin) can now safely store salt under the same roof with expensive equipment—thanks to specially-treated, corrosion - resistant building panels incorporated into steel construction.

Just about the time when the county board approved appropriation of funds for a new equipment building, the Wisconsin State Highway Commission launched its "Ice-Free Highway" program. This involves salting of all icy state trunk highways and provides for payment to counties for storing the salt used on state highways. Counties are reimbursed at a rate of $2.00 per ton per year for this service.

The problem facing the county commissioners was to provide storage space for both the highway maintenance equipment and the salt. To make matters worse, salt is usually delivered in carload or truckload lots to take advantage of bulk rates. Unloading is handled by high-speed screw or belt conveyors which usually form much salt dust, highly undesirable on equipment.

After taking all factors into consideration, including construction cost, county officials chose an Armco pre-engineered steel building with the following design criteria: 1) About 8,000 sq. ft. of floor area; 2) wall height of 14 feet; 3) about 1,000 sq. ft. of the total floor space to store three carloads (150 tons) of salt; and 4) salt storage area to be completely sealed from the remainder of the building to protect equipment.

A. C. E. Agricultural Supply Co., Manitowoc, Wis., erected the building with 22-gage Armco Steelox roof and wall panels, 20-gage bulk storage panels and Swartout vents. The building itself is a rigid-frame structure 160-ft. long and 50-ft. wide with walls 14-ft. high. Access to the building is provided by four overhead doors and three utility doors.

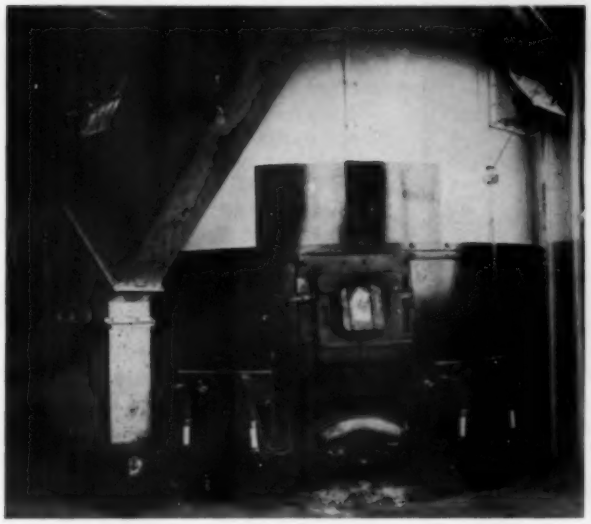
The Steelox wall and roof panels of the 50 by 20-ft. salt storage area are painted with a Bitumastic coating for protection from the salt. This area is completely sealed from the equipment storage area. □□□

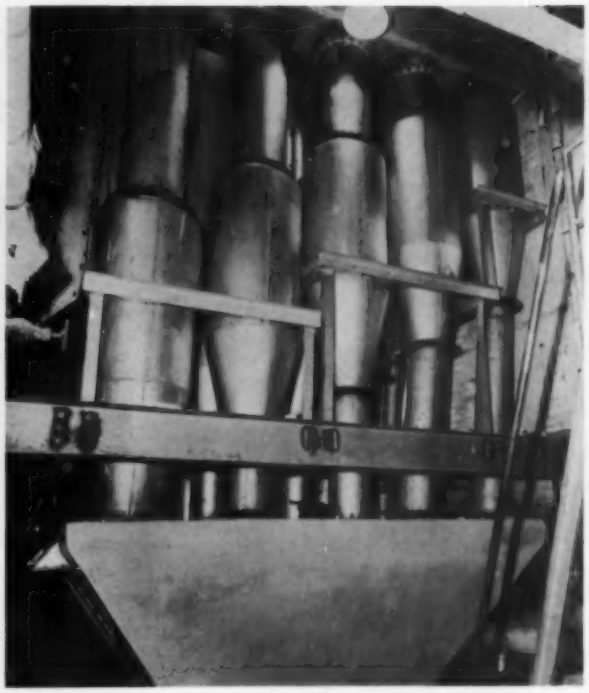
● **SALT FOR** winter snow and ice control is stored in 50′ x 20′ sealed area of the building. Walls and ceiling have a bitumastic coating to protect from salt corrosion.

● **EQUIPMENT** storage area is 50′ x 140′; walls are 14 ft. high. To prevent possible damage to equipment, this area is completely sealed off from salt storage section.

● **TO ELIMINATE** air pollution resulting from changes in refuse characteristics, John Wood dust collectors were used.

● **DUMPING** grates were remodeled to provide for hydraulic instead of hand operation; and ducts were provided to supply additional under-fire air and air to the over-fire doors.





CONTINUED IMPROVEMENT for the HEMPSTEAD INCINERATOR

WHEN the Town of Hempstead put its incinerator into operation in 1952, it pioneered many unique design features. Such items as waste heat, high pressure steam boilers, electric power generation, mechanical dust collectors, low stub stacks, boiler feed water condensers and mechanical conveyors for handling residue were incorporated into a plant that architecturally looks more like a modern school than an incinerator.

Since that time the character of refuse has changed materially. The proportion of dry material and garbage has more than reversed from the 60 percent garbage and 40 percent paper encountered fifteen years ago to today's 20-30 percent garbage and 60-70 percent paper and cartons. This has resulted in much higher operating temperatures and a consequent requirement of large furnace grate area, more primary air for combustion and even larger quantities of secondary air for cooling the combustion gases. Also the change has resulted in more fly ash, with a consequent requirement for better equipment to eliminate air pollution nuisance to the surrounding community.

Modernization Program

Four years ago the Hempstead Town Board approved a program of modernization recommended by the incinerator operating staff, assisted by its consulting engineers, Nussbaumer, Clarke & Velzy, to enable the plant to perform as well with today's refuse as it did when first put into operation. This was done in several stages.

The first stage was to replace the gravity brick walls in the combustion chambers with Detrick sectionally supported refractory tile walls. This reduced brick maintenance costs and enabled the units to operate at higher temperatures. At the same time, a wet bottom with a hydraulic sluicing system was installed to convey the fly ash from the combustion chambers to the fly ash lagoon located several hundred feet from the plant. This system, designed and furnished by the Beaumont Birch Company, eliminated the need for manually handling the fly ash and increased removal efficiency. Moreover, the fly ash can now be removed without shutting down the furnaces. Overfire air doors were added at the time to cool further hot gases. Additional retractable soot blowers were installed to keep the boiler tubes cleaner and lessen manual cleaning.

Addition of hydraulic power operation to the furnace dumping grates started the second phase of modernization. This allowed the furnace operation to be changed from a batch system to a modified continuous type of operation. At the same time newly designed stoking arms were installed to provide better stoking and turbulence of the bed to eliminate formation of clinkers. These were furnished by Morse Boulger, Inc., the original furnace designer. The new arms were adopted after observation of similar equipment installed at the Jersey City incinerator. Furnace temperatures can now be maintained more evenly, thus reducing thermal shock to refractories and eliminating violent fluctuations in the boiler steam flow.

● **ENLARGEMENT of storage pits was necessary to care for increased bulk of refuse. Cranes for charging the hoppers were modernized and cabs for operators were added.**

The change in refuse character resulted in an increase of volume for a given weight of refuse, making it necessary to enlarge the storage pits. The cranes were modernized by adding cabs so that the crane operator could handle the material from the far ends of the extended pits.

The chain and sprockets on the residue conveyors are subject to extremely severe operating conditions caused by non-combustible metals and fused glass. In an effort to secure longer life, a sample of the special chain developed by the Beaumont Birch Company for incinerator residue conveyors was installed. The life was found to be two to three times as long as the chain previously used. In view of this, Town of Hempstead officials ordered all conveyor chain and sprockets to be replaced with this special material. During about eighteen months of operation it has worked very well.

The final phases of design could not be started until the results of the foregoing improvements were evaluated. After a study of the operations and completion of a dust loading study made by Wisconsin Testing Laboratory, it was found that an increase in combustion and cooling air was needed.

At the same time the plugging in the existing mechanical collectors was studied and it was decided to install new type collectors together with larger fans and motors. Large diameter involute type cyclone collectors were furnished by the Air Pollution Control Division of the John Wood Company together with Buffalo Forge fans having inlet air volume control dampers. The fans were powered by Elliott wound rotor motors with Cutler Hammer eleven-step controls. This equipment was coordinated by the collector manufacturer to meet the requirements established by the consulting engineers and the plant staff. The cooperation of everyone concerned resulted in a considerable saving in shutdown time normally associated with supplying equipment of this magnitude.

Due to today's higher Btu value of refuse it was found that larger condensers would allow more efficient plant operation. Cleaver-Brooks condensers, especially designed to handle the brackish water utilized at the plant, were furnished.

Although it was desirable to make the changes quickly, a planned approach was adopted by the Hempstead Town Board which kept the plant in operation with a minimum of shut down time. Each improvement was done in a sequence that allowed for complete evaluation so that full value could be utilized in the next stage of modernization.

The current Presiding Supervisor of the Town of Hempstead, Palmer D. Farrington, is continuing the modernization of the Town's incinerator to provide the Town residents with the most efficient service at the greatest possible economy. Edward P. Larkin, former Presiding Supervisor, William J. Landman, Superintendent of the Department of Sanitation, Fred Trautwein, Superintendent of the Incinerator, and William Morgan, Assistant Superintendent, all contributed greatly to the success of the program.

How Cities Use Odor Control Chemicals

Out of 1,250 questionnaires returned by City Engineers and Directors of Public Works to the Editors of PUBLIC WORKS, 36 percent or 451 cities reported a greater or less use of odor control or odor masking chemicals or compounds. Of those reporting the use of such chemicals, 60 percent or 271 used them at the sewage treatment plant or in connection with such functions as drying sludge on beds. Application to refuse collection vehicles was reported by 151 or about 31 percent; and to sanitary landfills or dumps by 98 or just under 22 percent. Other usages, reported by a total of 81 cities, included lift stations, manholes, catch basins, sewers and overflow areas. These data do not include the use of chlorine in preventing hydrogen sulphide formation in sewer lines.

Use of odor masking or control chemicals in lift stations was reported by 19 cities; in manholes in 12 cities; in catch basins and street inlets in 22 cities; and in sewer lines generally in 28 cities. A few places reported using such chemicals in drainage ditches, stagnant puddles and similar areas.

Though it might appear that the use of these odor control and masking chemicals would be greater in the warm southern areas, a surprisingly large use was reported in many northern areas. For instance, 33 cities in the New England states reported using them; 23 reported from Wisconsin; 12 from Minnesota; 50 from California; from Pennsylvania 35; and from Florida 15.

These data will be supplemented by a second installment of returns which is expected to aggregate nearly a thousand more cities. However, the information presented here is sufficient to indicate that these chemicals are recognized as an accepted and useful tool in a great many cities. The 1,250 returns tabulated so far represent about 22 percent of all cities in the population groups surveyed; and this indicates, on a percentage basis that about 2,000 cities use this means for eliminating or reducing complaints from odors possibly resulting from waste disposal operations.

Development of a New Water District

V. A. VASEEN
President,
Ripple & Howe, Inc.,
Consulting Engineers,
Denver, Colorado

Despite financial problems which necessitated redesign of parts of the system, the Clifton, Colorado, Water District has been able to install an automatic filter plant and distribution mains which serve a growing number of customers.

PRIOR to development and installation of an adequate water supply and distribution system, the Clifton, Colo., area had a domestic water supply consisting almost entirely of cisterns filled from tank trucks. Customers bought domestic water at Palisade and Grand Junction at the rate of $3.00 per thousand gallons delivered to the cisterns. Inadequate and unsatisfactory ground water made it almost impossible to plan for domestic or municipal water from a well supply.

In the past several large irrigation canals taking their water from the Colorado River served the Clifton-Palisade area in an agricultural capacity. However, in the last ten years, due to the intensive growth of Grand Junction as headquarters for uranium mining companies and related industries, the entire valley has been developing into residential, commercial and industrial use.

The potential of the area was seen by a group of far-sighted personnel headed by R. L. Strain, Ira Pond, Marvel Dilley, Ray Kronk, Fred Waters and Ralph Oberly, who instigated the formation of the Clifton Water District from information provided in a report by Ripple and Howe, Inc., consulting engineers. The Water Board was legally formed according to 1953 Colorado Revised Statutes, and endeavored to solve the problem of domestic water supply throughout the 15 square mile area.

A supplementary report prepared in 1955 by the engineers recommended that the community purchase water from the "Hallenbeck Line," a new raw water feeder main installed south of the District by the City of Grand Junction. Water obtained from this supply line would require the installation of 33,200 feet of pipe to convey it to the District. The City of Grand Junction was willing to sell raw water to the District at between 16 and 18 cents per thousand gallons.

According to the report, the new lines of the District were to be sized sufficiently to supply water for domestic population equivalent to 4,000 persons, with provision for minimum irrigation and fire protection; when the District becomes more densely populated, larger mains would be installed to supplement the original lines. The 1955 report estimated the cost of the system, including the supply mains, to be approximately $660,000.

A survey of the persons living in the District indicated that 70 percent of the users would be connected the first year; that all of the existing potential users would be connected at the end of a three-year period; and, it was estimated that there would be a 5 percent increase in the number of users per year. At the time of the 1955 report the District contained 608 potential domestic users and 43 businesses, as well as several schools, churches and other users. Also, approximately 205 additional potential connections existed in the area to the west,

WATER is treated by these two automatic valveless water filter plants. Normal capacity is 118 gpm, maximum rate 235 gpm. Water system replaced hauled-in supply.

north and south of the organized District, which eventually could be included into the District. It was recommended that a connection charge of not less than $160 should be made to each user, with the cost of the meter pit and the connection to the house also to be paid for by the user. Water rates recommended to the District were as follows:

Water Use, Gallons	Cost Per 1000 Gallons
First 5,000	$6.00 minimum
Next 5,000	.36
Next 10,000	.32
Next 20,000	.28
Next 40,000	.24

Additional purchases would be by contract agreement. Outside of the District, users would pay 1½ times the District's established rates.

Plans and specifications were completed during the summer of 1956 for a water distribution system consisting of 35,340 feet of 2-in. pipe; 94,820 feet of 3-in; 65,830 feet of 4-in.; 11,170 feet of 6-in.; 42,970 feet of 8-in.; 31,400 feet of 10-in.; and 1,600 feet of 12-in. pipe with pertinent valves, hydrants and fittings, together with a rapid sand filter plant, designed to operate at rates of 200 to 440 gpm. Bids for the pipe, which was to be purchased by the City; for installation of the pipe; and for construction of the filter plant and reservoir totalled $685,000, including engineering costs. A bond issue in the amount of $700,000 was planned to finance this work. However, at the time of the letting of this equipment, the District was advised by the bonding firms that the bonds would have to be sold at a 4¾ to a 5 percent rate and therefore it was recommended that the District wait for several months to secure better interest rates. This advice was followed by the District but the financial situation in the national bond market worsened in the next several months. By the time the District entered into agreements to proceed with the system, it was necessary to sell the bonds at a 5 percent interest rate and a 6 percent discount. This discount reduced the total amount of money available for construction, thus reequiring re-design of parts of the system, particularly the water treatment phase. The ultimate decision was to buy a package water treatment plant as manufactured by Permutit Company of New York. The final cost of complete construction was $711,045.90.

Filter Units

The filter unit as installed consists of two automatic valveless gravity filters, each housed in a tank 10 ft. in diameter by 14 ft. high. The units contain 24 inches of filter media in the bed and operate at the rate of 118 gpm average flow or 235 gpm maximum flow. These filters operate until the loss of head through the filter bed reaches a predetermined level, at which time the filtering action stops and the media is automatically backwashed by a supply of water previously filtered and stored in the unit. At the end of the backwash cycle the unit returns to service.

The raw water purchased by the Clifton Water District from the City of Grand Junction has the following analysis: Calcium, 80 mg/L; magnesium, 3 mg/L; sodium, 5 mg/L; and chloride, 0 mg/L. The methyl orange alkalinity is 30 mg/L and the pH is 8.

The small amount of colloidal clay turbidity in the raw water does not require pre-treatment coagulation in order to provide a satisfactory finished water. During the summer, fall and winter run-off, turbidity drops to 5 to 10 mg/L. Under these conditions the filters are backwashed every three or four days. In the Spring of the year when turbidity is greatest, averaging 30 to 40 mg/L, the filters ordinarily require a backwash every 36 hours and under maximum turbidity conditions, once each day.

Reservoir capacity provides approximately two days storage during periods of maximum water demand. This enables the district to suspend operation of the filter plant during the few occasions of flash floods and turbulent water which otherwise would require pre-treatment facilities.

The Clifton Water District pays the City of Grand Junction 17½ cents per thousand gallons of raw water. Operation of the filter plant and maintenance of storage facilities adds an average of 5 cents per thousand gallons to the cost of the water supplied to the District. The District operates on a gravity system and consequently there is no cost for pumping to the distribution system.

In view of the financial picture of construction cost and the discount of the bonds for the original available capital, the District has had to revise its financial approach. Consequently the tap fee was increased to $175. The mill levy dropped with an increase in customers as shown below:

Year	Taps	Mill Levy
1955	—	$0.55
1956	—	5.71
1957	321	5.97
1958	415	20.04
1959	550	19.52
1960	648	17.90

The District has proceeded to grow in a very satisfactory manner and should fully solve its financial problems within a few years. Officials of the District are R. L. Strain, president; Lehman Pond, secretary; Eugene Hansen, treasurer; Walter Shore, vice-president; and W. F. Gross, board member.

Foresight of the District's Board of Directors has opened the way for maximum development of a 15-square mile area, thus benefiting the general welfare and economic picture of the entire western slope of the state of Colorado. □□□

Streamlined Pedestal Poles

CONTEMPORARY lighting standards in which the usual taper has been reversed for a graceful, modern effect, line the parking area for the State Capitol in downtown Nashville, Tennessee. The new pole has many uses—for small parking areas, roadways, driveways and general lighting. Made by Kerrigan Iron Works Company, the new pedestal pole is available in lengths from 10 to 14 feet in round and octagonal aluminum and octagonal steel.

Courtesy Maryland State Roads Comm.

● **EARLY application of calcium chloride and plowing soon after results in open road. Note drifts along snow fence at left, away from road.**

Maryland's SNOW CONTROL PROGRAM

WILLIAM F. HALLSTEAD

ONE OF THE best indications of the kind of a winter Maryland suffered in 1960-61 was found in the State Roads Commission's attempt to schedule a Snow Control Conference in January, 1961. The conference had to be cancelled. The reason? A raging snowstorm.

Throughout the winter, in the Baltimore area approximately 50 inches of snow accumulated where the normal snowfall averages 22-30 inches. In Western Maryland where 95 inches of snow are a winter's average, the area was inundated with some 160 inches. Drifts reached depths of 15 feet, and it took long memories all over this border state to recall winters of like severity and duration.

For a state not exactly noted for its rugged winters, Maryland did an excellent job of handling its worst since the mid-1930s. Under the direction of Chairman-Director John B. Funk, more than 1600 miles of state highway were kept cleared on a "bare pavement" program in effect for the past 3 years. Urban and rural areas were cleared rapidly after each storm, and even the most severe downfalls failed to snarl operations for any appreciable period of time.

Early Warnings Essential

The Commission's weather information center is the communications room at the headquarters in Baltimore City. Here are gathered forecasts from the Weather Bureau at Baltimore's Friendship Airport plus on-the-spot reports from the state's 7 highway districts. When a forecast of an impending snowstorm is received in the communications room, all districts are immediately alerted by radio. The districts then report back as the snow actually begins. This information is relayed to the Weather Bureau to assist that agency in providing additional forecasting with a greater degree of accuracy. This revised information is then radioed from the communications room to the areas affected.

The autonomous maintenance forces of Maryland's counties depend partially upon state information and avail themselves of such additional forecasting services as are locally available. These supplementary sources include local state police headquarters, Washington Airport and other agencies.

The Commission's communications section announces daily weather forecasts over all three radio channels at designated hours. Between November 15 and April 15, a 24-hour radio watch is maintained in the district offices for the purpose of alerting personnel of impending weather conditions.

The primary factor in Maryland's success in winter maintenance is one of timing. Though the state has in the recent past experienced some mild winters, the Commission regards snow clearance as a serious and high-priority problem. This high state of preparedness served Maryland's citizens well during the unusually savage past winter. Under present directive, field forces are dispatched ahead of predicted storms, applying chemicals in the early minutes of precipitation. In some instances, this technique has eliminated the necessity of plowing. Where plowing has subsequently

been required, the preliminary chemical application has prevented adhesion of the snow to the road surface and has made plowing a great deal easier.

Chemical Control

Maryland has large 150-ton, gravity-feed salt bins erected in 5 railroad locations through the state. These bins, equipped with under track screws, have been installed at a cost of approximately $18,000 each. In addition, the state maintains stockpiles of cinders, sand and chlorides located with consideration given to safety, accessibility and natural topography plus length of haul of payload and deadhaul travel. Storage sites are paved with bituminous material, protected on three sides when possible and covered with tarpaulins or roofing.

Cinder and sand stockpiles are treated with 75 to 100 lbs. of calcium chloride or 150 to 200 lbs. of sodium chloride per cubic yard. For special treatments such as applications on ramps, chlorides may be mixed as follows: 3 parts sodium chloride, 1 part calcium chloride and 5 parts abrasives.

Stockpile locations are reviewed annually to take into account the rapid expansion of the state highway system. Storage sites are to be prepared this year so that 80 percent of the anticipated quantities of materials can be delivered prior to November 1st. The Commission has found that materials deliveries following that date are often delayed due to the sudden increase in demand with the onset of winter.

Practice is to apply chemicals as soon as a pavement surface retains snow or slush. Salt is usually used, and it is spread in a 6 to 8-ft. width on pavement crowns. With the aid of higher temperatures and traffic, this produces a brine which spreads over the road's surface. Chemicals are not used to reduce snow bulk but to retard adherence of precipitation to pavement.

Plowing

Plowing operations start shortly after the application of chemicals, and continue for the duration of the storm until all pavements and shoulders have been cleared. Frank P. Scrivener, Chief of the Bureau of Maintenance, states that when plowing gets underway promptly and is able to keep "ahead of the storm," the bare pavement technique can prove significantly cheaper than a tardy attack on a choked highway.

In the past 5 years, the Commission has added 46 plow-equipped trucks to its equipment inventory plus several other snow-removal units. In addition to this state-owned equipment, the Commission hires approximately 100 trucks and furnishes them with plows and spreaders. Each truck carries a crew of 2 with the extra man acting as flag and safety man. Snow-clearance units follow pre-determined routes—a policy that proved very successful during the heavy snows of 1960-61.

A particular problem in this area of the Atlantic seaboard is the alternate thawing and freezing throughout the winter. This oscillation of the temperature above and below the freezing mark requires careful placement of windrowed snow off the high side of superelevated pavements, especially at interchanges. A completely bare pavement ramp can become a sheet of glare ice in a matter of hours if plowed snow is placed so that its runoff can flow back across the pavement.

Another important problem inherent in the plowing operation is one fairly common to every well-populated state in the snow belt. This is the matter of private entrances. It is a practical impossibility for state plows to open or leave open all entrances, irritating as it is to property owners to find their entrances blocked after a long hand-shoveling job. Commission drivers are under orders to minimize this inconvenient blockage.

Early in the winter, 33,000 guide stakes are erected along 400 miles of Maryland's dual highways. The 48-inch-high stakes made of 2 x 2's and painted a high-visibility yellow were placed 4 feet off of each pavement edge at 200-ft. intervals except on interchange ramps where spacing was reduced to 75 feet. The stakes served as a guide for snow removal equipment making the first runs in heavy snow and also as a reference for motorists using the highways in heavy snow prior to the arrival of removal equipment. The cost of this marking program was approximately $18,000. The stakes were removed after the winter season so that mowing would not be impeded. They will be re-installed in the fall.

Communications

A vital factor in Maryland's snow control success has been the purchase and installation of radio equipment. In 1955, they had no effective radio communications system. Today the Commission has 400 mobile units and 27 base stations. This network is invaluable in locating, directing and supervising equipment and the prompt reporting of highway conditions.

The communications room located in Baltimore is in constant contact with district engineers and resident maintenance engineers. In addition, the communications net is tied in by radio with Pennsylvania, Delaware and Virginia and plans are underway to include West Virginia as well. The communications room is also in contact during storm periods with the District of Columbia through the Park Police by radio or by public service, and a direct line is maintained to Baltimore City's commissioner of transit and traffic. Contact with the Maryland State Police is maintained by radio.

Table 1—Maryland's Snow Removal Equipment

UNITS	As of 1955	As of Dec., 1960
Trucks, Dump, 2½ to 3½ Ton	318	349
Trucks, Dump, 4 to 10 Ton	32	25
Trucks with Hopper Spreader, 1½ to 2½ Ton	...	8
Trucks with Hopper Spreader, 5 to 7 Ton	1	15*
Total Trucks, all equipped with Snow Plows	351	397
Trucks, Rotary Type Snogo or Bros	2	4**
Loader, Front End	39	56
Motor Grader	91	86
Spreader, Material, Air	9	31
Spreader, Material, Hopper	1	21*
Spreader, Material, Rotary-Traction	253	424
Tractor, Crawler, Dozer or Loader	23	25

*Includes in the category "Trucks with Hopper Spreader, 5 to 7 Ton" are 2 government surplus coal hopper trucks converted to material spreader trucks. Therefore under the category "Spreader, Material, Hopper" these two hoppers are not shown as they were not purchased separately but came with the trucks as a complete unit.

**In addition to the 4 units listed, the commission also has the use of a Sicard unit based at the Baltimore Harbor Tunnel.

● SNOW in the "Sunny South." This king-sized drift on US 219 in Garrett County required heavy equipment for clearing.

● FOUR rotary type plows are owned by the Commission for work like this; and one is available from the Harbor Tunnel.

Maryland's 23 counties, with their separate but related snow control responsibilities, are almost as well organized in radio communication. A poll in February, 1961, revealed that 17 of the 23 counties had radio facilities as part of their communications set up.

Public Cooperation

One of the biggest headaches brought to light at the Maryland Snow Control Conference (it finally was successfully convened in early February) was the difficulty of convincing the public that it, too, had a measure of responsibility in the problem of snow control.

A comment that received considerable support was that too many private vehicles are simply not equipped to travel in snowstorm conditions. They block streets and highways quickly and trouble is compounded when snow removal equipment is unable to get past these blockages.

Maryland's House Bill No. 214, passed in April, 1961, should succeed in correcting the majority of these difficulties on state-maintained highways. In essence, the bill empowers the State Roads Commission to designate snow emergency routes upon which it will be unlawful to park or to drive without snow tires or chains during emergency periods.

Because this type of state law is not yet common throughout the country, it is presented here in its entirety:

Be it enacted by the General Assembly of Maryland, that a new section, to be known as Section 66A of Article 89B of the Annotated Code of Maryland (1957 Edition), title "State Roads Commission", subtitle "Duties and Powers", said new section to follow immediately after Section 66 and to read as follows:

66

A. The State Roads Commission is hereby authorized to designate such State Highways as it deems appropriate as "Emergency Snow Routes" and such highways when so designated shall be appropriately signed. After the highways have been designated and signed, and a "Snow Emergency" declared as hereinafter pre-scribed, it shall be unlawful for any motor vehicle to travel or attempt to travel upon such highway unless it is equipped with chains or unless both rear wheels are equipped with snow tires. For the purpose of this Act snow tires shall mean those tires which are normally designated by the manufacturer as snow tires and shall be in a good state of repair. It shall also be unlawful to park a vehicle on such a highway during the period of emergency and the State Police are hereby authorized to have any such vehicle so parked towed from said highway.

The Superintendent of the State Police or his representative shall have the authority to call such emergency for the State Highways so designated as a whole or for such State Highways in the State as he deems necessary which emergency shall continue in force and effect until the Superintendent or his representative shall declare it is no longer necessary.

Any person, firm or corporation violating the provisions of this Act or the rules and regulations made pursuant hereto shall be deemed guilty of a misdemeanor and upon conviction be fined a minimum of $1.00 or a maximum of $100.00.

And be further enacted, that this Act shall take effect June 1, 1961.

Previous to the passage of this bill the Commission has had the power to declare parking bans on routes in 5 counties. The new bill will make available to the state emergency powers that have proved successful in Baltimore in recent years.

Costs

The cost of snow removal during the Maryland 1960-61 winter was a record $2,386,930. This amounted to about $456 per mile of state highway. The 1959-1960 season cost $1,400,000. A mid-season breakdown of snow removal cost data showed that 47.7 percent of the total went into labor, 25.1 percent into material, 26.2 percent into equipment and 1.0 percent into other costs.

Optimum Program

What is the best means of snow control? Maintenance Bureau Chief Scrivener says that a few days of sunshine following a storm work wonders. Marylanders have often been able to count on this kind of benign weather in the past. But the winter of 1960-61 threw an icy mantle over the State that kept snow on the ground from early December to late February.

To account for the Commission's success with the raging '60-61 winter, Mr. Scrivener and Assistant Chief G. Bates Chaires cite these 5 key factors: 1) Extensive use of chemicals applied at the very beginning of the storm and followed promptly by plowing; 2) an effective two-way radio communications net; 3) the purchase of additional equipment, including specialized units; 4) the establishment of pre-determined routes for each unit; and 5) the high morale and loyalty of dedicated field forces. □□□

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The new M-B PACK-KING gives you a new concept in a modern refuse collection body with all the advantages of hydraulic packing and side loading, but without the drawbacks of other units having these features. With the powerful hydraulic packing mechanism located up front in the body, there's no need for a heavy, complicated tailgate. And because this compact packing mechanism has no space-wasting packer plate traveling the length of the body, there is no "fall-back" of material, either in the body, or in the loading area. That's also why the packing cycle is faster, enabling you to finish routes in less time.

In addition, you get real cost advantages. The PACK-KING is priced competitively with old-style side loading bodies — way below rear-loading hydraulic units. Because of clean, simple design, maintenance costs are cut to the bone.

The new M-B PACK-KING has been under development for two years, and has been thoroughly tested on typical routes to give you more profitable performance right *now!* Available in capacities of 14, 16, 20, and 24 cu. yds., the PACK-KING can be mounted on economical shorter wheelbase, shorter cab-to-axle, and lower G. V. W. trucks — is fully adaptable to "containerized" collection. Now study the detailed features at the right, then mail the coupon *today* for additional information.

. . the powerful packer with more payload!

Greatest Packing Pressure; High Density Compaction Tremendous packing pressure of 10 lbs. per sq. inch of packer plate — higher than any other side-loading unit — due to high volume pump, big bore, short stroke cylinders. Refuse is lifted with a curved, king-size "Load-Hoist" plate, then rammed into the body by the powerful "PAK-TITE" packer plate. Because the packing area is located at the top of the body, material circulates throughout the interior, eliminating any voids, and assuring high density compaction, from top to bottom, front to rear.

No Annoying "Fall-Back" When Loading or Packing The huge loading area is always free of material after a packing cycle . . . from the first load to the last . . . because the "PAK-TITE" packer plate acts as a retainer, holding compressed refuse in the body. Since there is no "traveling-bulkhead" type packing plate, there is no re-packing of the load on every cycle. Compression of the load remains constant, without material fall-back resisting packing pressure.

Faster Packing Cycle; More Blocks Covered Each Day The elimination of a plate traveling the length of the body and returning means a faster cycle. A high volume hydraulic pump and short stroke, big bore cylinders also contribute to cycle speed, keeping crews working — not waiting.

Simple, Low Maintenance Design Nothing is more simple than the PACK-KING method. Only three fast-acting hydraulic rams to lift and pack the load — just simple, powerful hydraulic pressure with easy manual control or optional fully automatic operation.

Sturdy, "Rock Body" Construction Built to "take it" for years of rugged use, the PACK-KING body is unitized for permanent rigidity. Heavy steel members surround the body, with special reinforcing at the loading area. There's no possibility of the roof or sides bulging from packing pressure.

Complete Safety . . . For Crew and Bystanders No heavy tailgate to raise and endanger personnel. Loading doors on both sides permit curb-side loading from either side of the street. Crew members are always within sight of the truck driver. Doors must be kept closed when packing, or mechanism will not operate.

Plus Many More Important Advantages for More Profitable, Efficient Refuse Collection.

FASTER,
SAFER DUMPING

The PACK-KING has *twin* telescopic hoists mounted *outside* the truck chassis frame. This outboard mounting provides solid 4-point support while dumping, insuring better overall balance, especially on uneven terrain. Locating the packing mechanism at the front of the body also contributes to the safe balance. There is absolutely no danger of "up-ending" the truck, because there is no heavy, unwieldy tailgate to raise prior to dumping. A 4" taper from front to back within the body allows the load to slide out easily. The large rear safety doors are easily unlatched from the side, keeping personnel clear of the load.

SEE THE PACK-KING AT THE A.P.W.A. SHOW...BOOTH C•33•34•35

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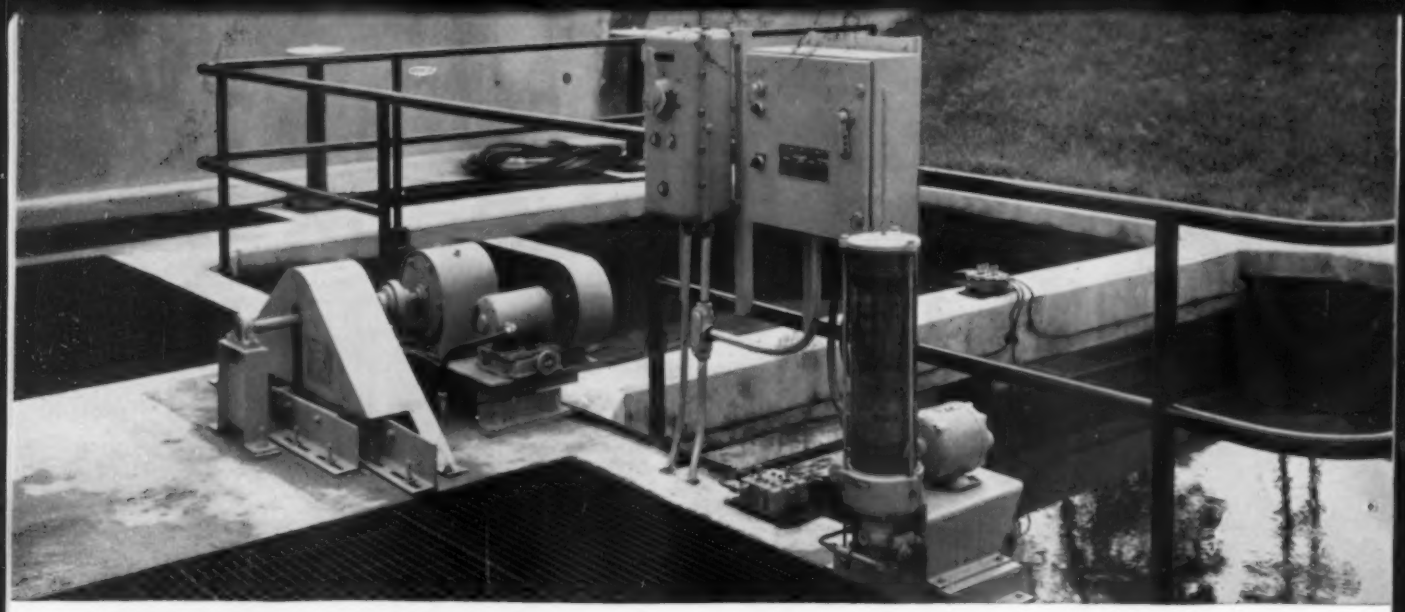

JEFFREY WATER TREATMENT SYSTEM SERVES NEW KENTUCKY HOMES

To provide for the growing needs of Winchester, Kentucky (pop. 10,149), J. Stephen Watkins, Consulting Engineers, called in Jeffrey sanitation engineers...specified Jeffrey flocculator and settling tank equipment. The new installation shown below incorporates Jeffrey's exclusive Floctrol® process to provide rapid flocculation with minimum chemical dosage. The compact settling chamber equipment pictured above features an automatic lubrication system that periodically introduces grease to underwater bearings. Jeffrey's Sanitary Engineering Division offers complete technical assistance in designing and equipping water, sewage and industrial waste treatment installations. For further information, write today for Catalog 952.

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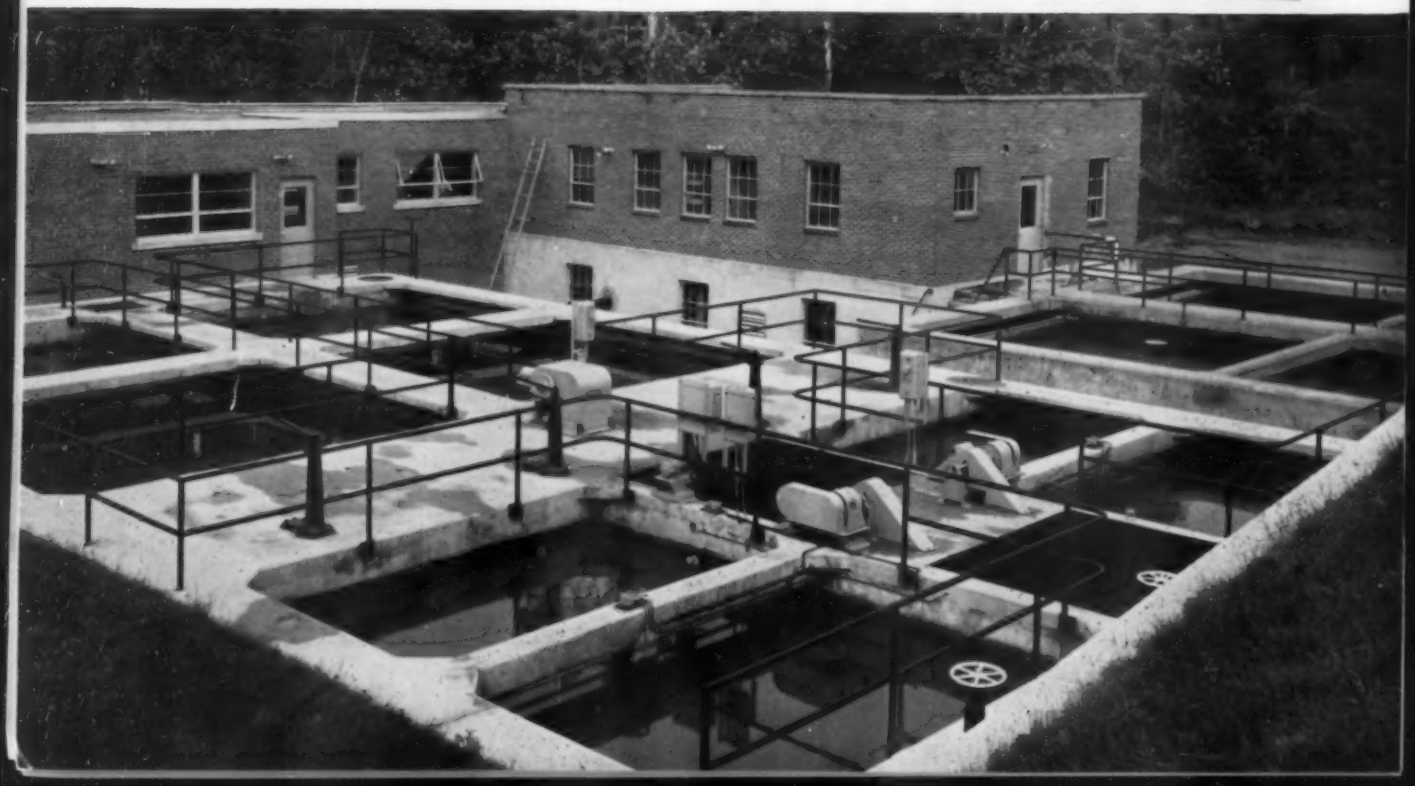

NEWS BULLETINS

AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

Research and Development Featured at 1961 Congress and Equipment Show

"Better Service and Lower Costs Through Research and Development" will be more than just a catchy theme for the 67th annual American Public Works Association Congress and Equipment Show in Minneapolis, September 24-27.

A workshop on the "Identification of Research Needs" will be the first open forum for a one year study designed to delineate the most important and promising areas of research in the public works field. Made possible by a $40,000 grant from the Ford Foundation, the year-long study is being conducted under the auspices of the APWA Research Foundation. A special committee appointed to oversee the project is composed of Samuel S. Baxter, commissioner of Philadelphia's Water Department and chairman of the Research Foundation's Board of Trustees; John Logan, chairman of Northwestern University's Civil Engineering Department; Edward J. Cleary, chief engineer and executive director of the Ohio River Valley Water Sanitation Commission; Richard Gallagher, director of public works, San Luis Obispo County, California; and Dean Fred Benson, director of the Texas Transportation Institute and city engineer, College Station, Texas.

Robert Bugher, APWA Executive Director, will serve as manager of the project; Professor Earnest Boyce, former chairman of the University of Michigan's Civil Engineering Department has been retained as a technical advisor; and David Vargas, APWA's Director of Research, will work with the Armour Research Foundation in carrying out the staff work involved in making the study.

At the Minneapolis Congress, the research needs workshop will include a talk by John Diederichs, director of Techno-Economic Research for Armour Research Foundation, and a series of break-up meetings to be conducted by members of the APWA Research Foundation's Board of Trustees. The discussion leaders at the workshop will welcome the suggestions of persons attending the Congress and encourage individual forethought as to the research needs and priorities in the public works field.

More News About This Year's Congress

More than 25,000 preliminary programs describing the 1961 annual Congress and Equipment Show were mailed to APWA members and others last month. The tightly scheduled, four-day (September 24-27) meeting to be held in Minneapolis is designed primarily to allow public works officials to exchange ideas on how to meet community problems, to present the latest in ideas and up-to-date practices, and to serve as a showcase for the most recent developments in equipment and supplies. The program is balanced with tours, a get-acquainted party and a special ice carnival on the theory that all public works and no play could make a dull stay.

Featured speakers will be James Webb, administrator of the National Aeronautics and Space Administration; Federal Highway Administrator Rex Whitton; and Congressman John Blatnik, a member of the House Committee on Public Works, Committee on Government Operations and chairman of the Special Subcommittee on the Federal-Aid Highway Program.

Municipal Refuse Disposal Book Now Available

A first-of-its-kind, comprehensive study of America's 1.5 billion-dollar-a-year refuse collection and disposal operation is now off the press.

A special APWA committee headed by Casimir Rogus, director of engineering for New York City's Department of Sanitation, spent five years researching, writing and editing "Municipal Refuse Disposal." Other committee members and contributors are Abraham Michaels, chief sanitation engineer, Philadelphia; Bernard J. Geisheker, Milwaukee's superintendent of refuse collection and disposal; Carl Schneider, consulting engineer, New Orleans; John R. Snell, partner, Michigan Associates, Lansing; Jean

L. Vincenz, immediate past president of APWA and director of public works, San Diego County, California; Leo Weaver, chief of the Water Quality Section of the Robert A. Taft Sanitary Engineering Center, Cincinnati; Theodore E. Winkler, engineer of waste disposal, Detroit; William A. Xanten, superintendent, Division of Sanitation, Washington, D. C.; and Edward R. Williams, sanitary engineer for the U. S. Public Health Service.

The book discusses the quantity and types of refuse, including considerations in selecting methods of disposal and practices, problems and recommendations relating to each of the important disposal methods and to the management of disposal facilities. Appended to the text are: 1) A collection of methods for the physical and chemical analysis of refuse; 2) sample ordinances and a digest of existing ordinances regulating refuse collection and disposal; and 3) standards for the design and installation of domestic incinerators.

Copies of "Municipal Refuse Disposal," the most authoritative book ever developed on this increasingly important subject, will be on display at the Minneapolis Congress. The 500-page volume contains 148 illustrations and 43 tables. Price of the book is $6 for APWA members, $8 for non-members. Members may obtain copies from Association headquarters. Non-members may write to the Public Administration Service, 1313 E. 60th Street, Chicago 37, Illinois.

Governor's Aid Sought For National Public Works Week

Governors of the 50 states have been asked to issue proclamations designating October 1-7 as "National Public Works Week." Last year, a majority of state governors complied with the request.

The governors' proclamations have served as valuable aids to the work of APWA chapters and Kiwanis clubs supporting the educational program associated with the NPWW observance. Many APWA chapters have formed special committees to implement ideas which are designed to make NPWW an event which will help bring recognition to deserving public works officials, to increase the citizen's awareness of the function and importance of public works projects and to encourage qualified and talented youngsters to consider a career in this field. These plans include conducted tours of municipal public works facilities, open houses, programming of public works oriented films on educational and commercial television stations, encouragement of local radio, television and press coverage of NPWW related events, seminars and other meetings designed to erase the communications barrier that may exist between the public and public works officials, and encouragement of the taxpayer's interest and support.

Both Kiwanis International, cosponsor of the second annual NPWW program, the Associated General Contractors of America, and other organizations are aiding APWA's efforts to make this year's observance a success. To date, more than 4500 kits describing this year's program and suggesting ways of implementing it in your community have been mailed on request. These kits may be obtained by writing Association headquarters.

Mississippi Public Works Officials Plan Meet

Mississippi public works officials are sponsoring a state-wide conference in observance of National Public Works Week, to be held at the King Edward Hotel, Jackson, on October 5 and 6, 1961.

SPEED AND SIMPLICITY...

Rear-end loading refuse bodies may look alike . . . may have similar dimensions . . . may be available in the same capacities . . . BUT THEY DO VARY IN PERFORMANCE! The TOP PERFORMER of them all is ROTO-PAC! Speed and simplicity are the reasons why.

Continuously moving flight bars speed refuse into the ROTO-PAC body to make it the fastest loader available today!

Simplicity of design enables loaders, regardless of experience, to operate the ROTO-PAC efficiently at all times.

Write, phone, or wire today for free literature, sound movie, or demonstration of the ROTO-PAC.

ROTO·PAC

...The ONLY Refuse Collection Body With CONTINUOUS LOADING!

a product of City Tank Corporation

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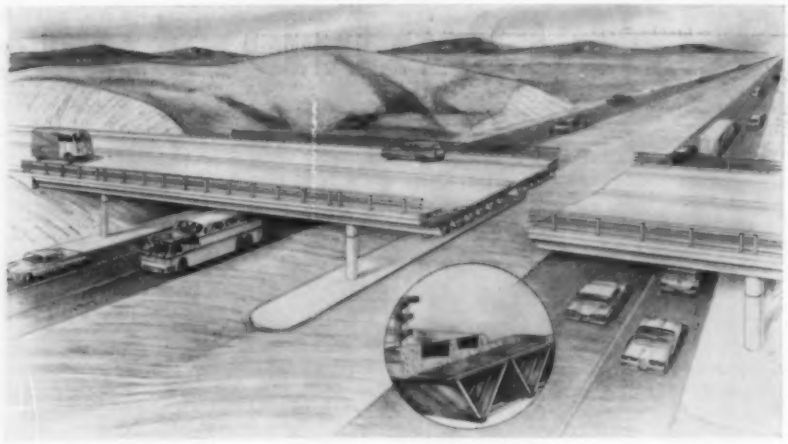
BOX 711 CULPEPER, VIRGINIA

A barbecue and tour of public works projects in the Jackson area will be featured diversions to scheduled panels on street maintenance, sewage disposal and refuse collection and disposal. The conference agenda includes a luncheon meeting at which officers of the newly-organized Mississippi State chapter of the American Public Works Association will be elected.

Conference arrangements are being handled by Frank Stewart, assistant city engineer, Jackson; E. M. Stiles, director of public works, Natchez; and John Teunisson, Jr., city engineer, Greenville. □□□

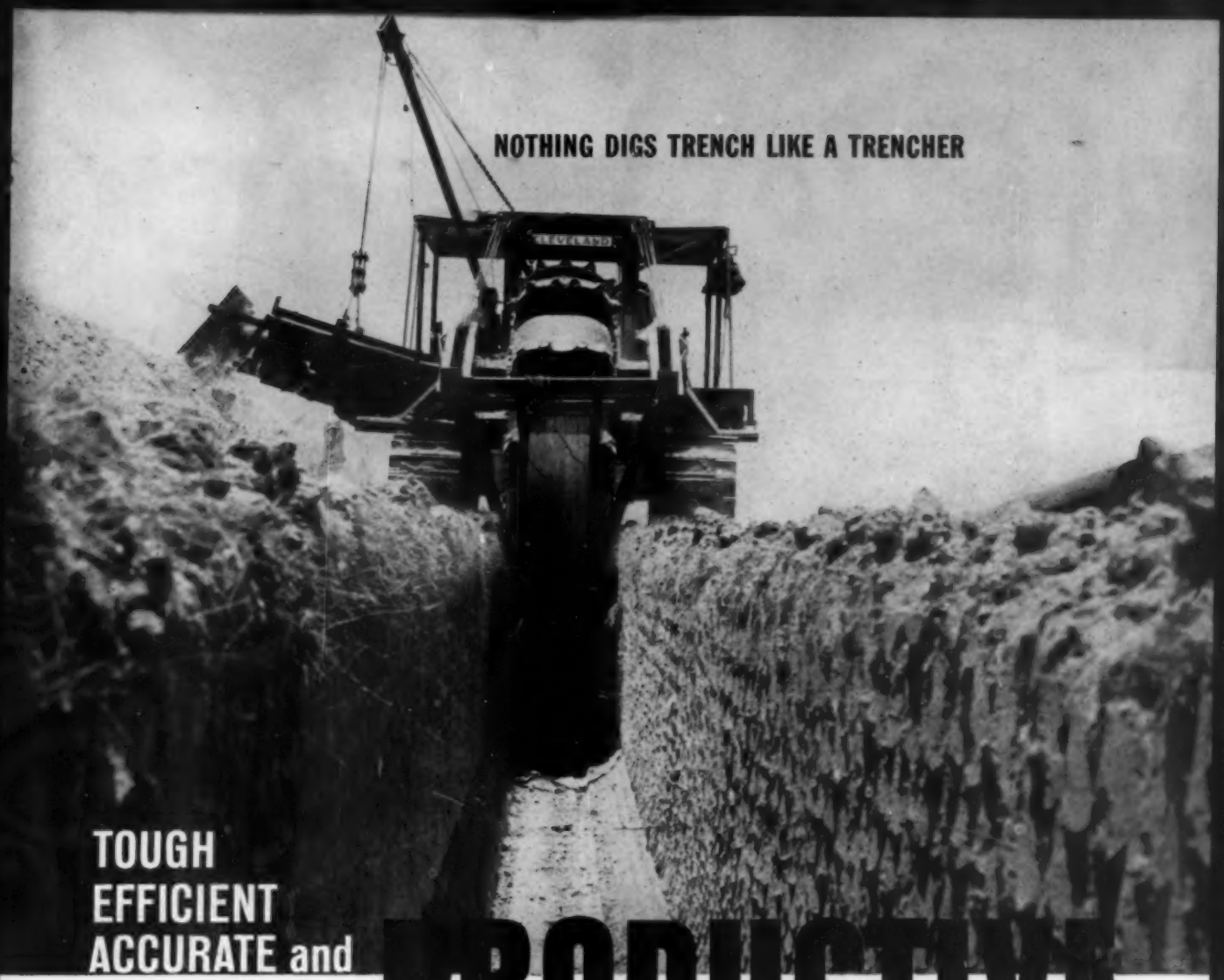
Pollution Abatement Gains in Ten Years

A study by the Chairman of the National Technical Task Committee on Industrial Waste, A. J. Steffen, in 1960 showed progress in fulfilling pollution abatement needs over the past decade. Data from 26 states that submitted comparable information shows a 74.5 percent increase in municipal treatment facilities and a 64 percent in industrial waste treatment, with a decrease in needs of 36.5 percent in municipalities and 44 percent decrease among industries.



Aluminum Bridges for Highways

TWO aluminum highway bridges which use cellular components will be in service this summer in Amityville, N. Y. Called the Kaiser Aluminum Unistress Bridge, the triangular-shaped components utilize an aircraft-type, stressed-sheet design. Bolted together edge-to-edge, the cells form a roadway base of any desired width. The unique design permits a highly efficient use of aluminum's favorable strength-to-weight ratio. Original price is competitive with conventional steel bridges in spans of 75 feet or more. Lightness and corrosion resistance of aluminum provide other economic advantages in erection and maintenance. The new type of bridge is being marketed by Kaiser Aluminum & Chemical Corporation.



TOUGH EFFICIENT ACCURATE and PRODUCTIVE

For fast, accurate, low-cost trench production no other type of excavating machine can compare with the modern, full-crawler-mounted, wheel-type trencher—the trencher originated and perfected by Cleveland.

Other-type excavators use stop-and-go, interrupted-cycle digging action suitable for other types of excavating work. The trencher's digging action is *continuous* and all operations are performed *simultaneously* . . . it travels . . . it digs and grades . . . it fines, elevates, conveys and deposits spoil ready for fast, economical backfilling.

The trencher employs the strongest, most productive digging element—the wheel. The most stable and maneuverable type of mounting—the full crawler—permits maximum exploitation of the wheel in continuous digging. Simultaneous crawler progress and wheel rotation produce positive forward crowd into the digging, and maximum utilization of power at the point of digging. Especially designed for lineal excavation, the trencher digs trench far more productively and economically than other types of excavators.

Investigate now the profit potential of a modern trencher —a dependable, accurate, productive Cleveland Trencher.

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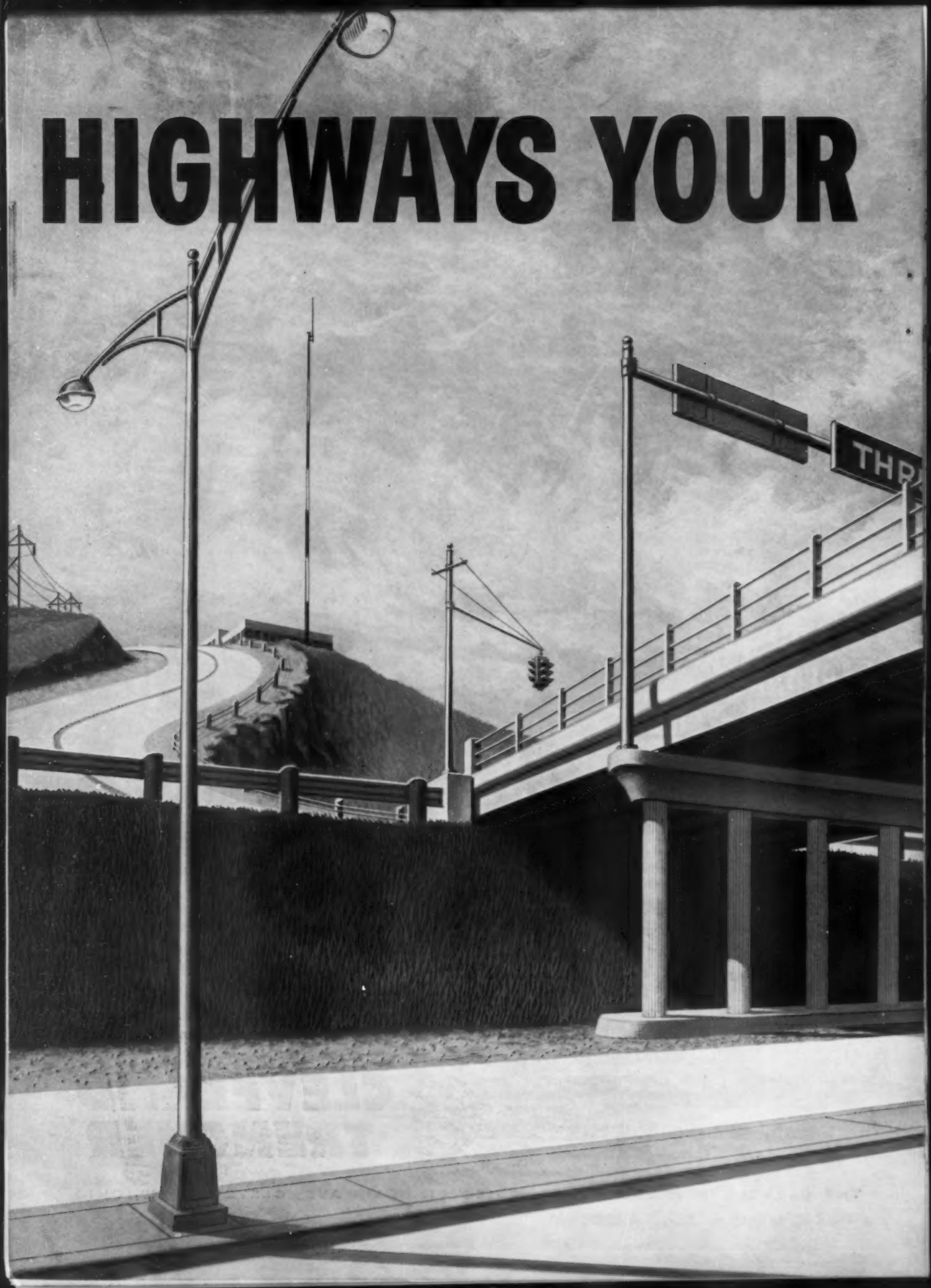
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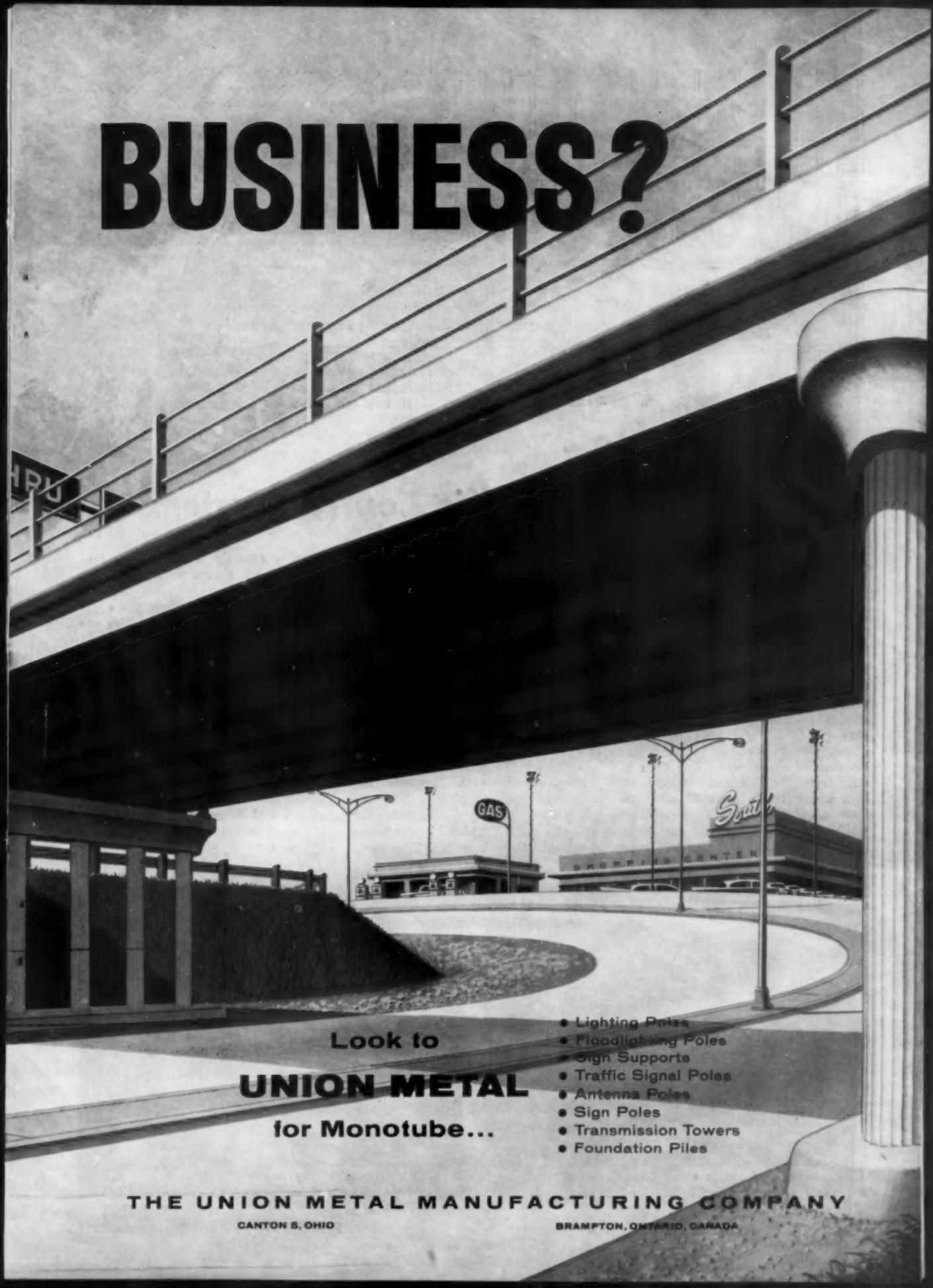

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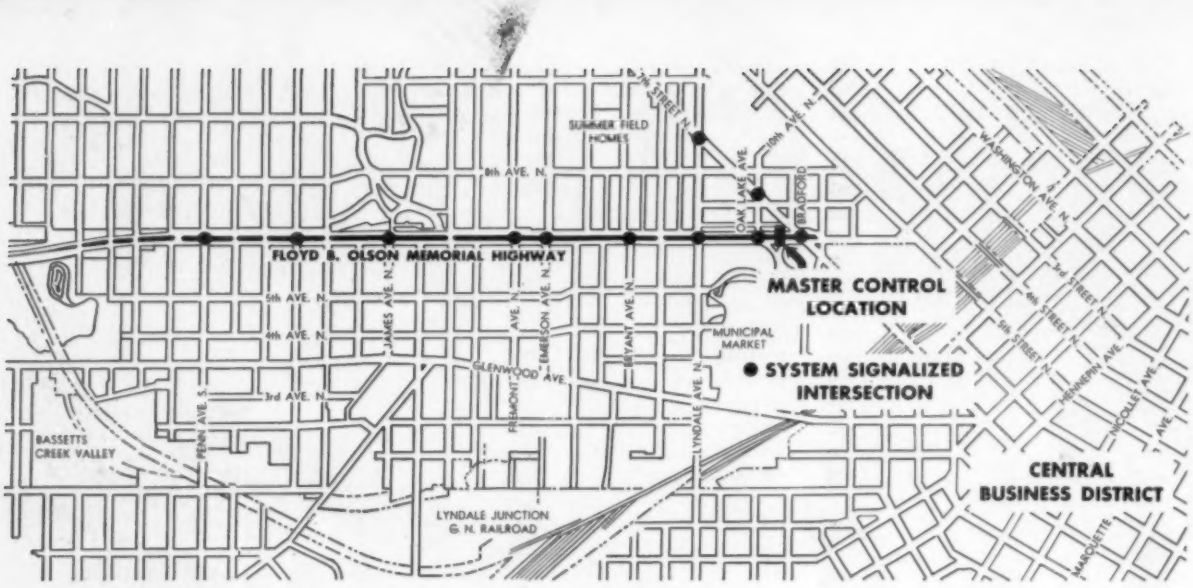

Minneapolis
Installs New Traffic Control System

DAVID R. KOSKI

Assistant Traffic Engineer, City of Minneapolis, Minnesota

CONGESTION has been significantly reduced along an eleven-intersection, one-mile stretch of our Olson Memorial Highway, leading toward 7th Street North. Both streets are arterial routes (Minnesota Route 55 and 116) into the downtown Minneapolis loop area. Because of the location less than a mile from the heart of the city, it is a heavy traffic area. Despite an increase of 20 percent in vehicular traffic during the last year, our new "EC" Traffic Adjusted Control System has reduced congestion by more than 25 percent.

Furnished by the Eagle Signal Company, Moline, Illinois, the system's "vehicle supervision" feature responds automatically to changes in traffic density and direction of movement.

The Master Controller provides for a program over-ride feature that may be used when it is known that a major influx of traffic is to occur within the system. During all "normal" periods, the computers supervise the area in accordance with current traffic sampling taken as the vehicles pass over detector pads imbedded in the pavement at strategic areas. The computer constantly "stores" these impulses for a preset period, ranging from one to ten minutes. At the end of this sampling time, the cycle length, splits and offset selections are automatically arranged and applied to the traffic light sequences at the individual intersections. The Master Controller is constantly measuring not only the volume of traffic but also the traffic density.

Sampling periods are not fixed. That is, they are not necessarily identical for traffic in both directions but can be individually adjusted for volume and density increase and decrease, within the designated range of the one to ten minutes.

● **DIRECTION** of traffic along Olson Memorial Highway is adjustable for volume and/or density increases or decreases.

● **FINAL** settings of the master controller in the median strip of the highway are checked by Messrs. Koski and Nelson.

Although the Master Controller responds instantly to the stored impulses from the detector pads at the end of the selected time interval, the adjustment of offsets, to bring the entire system as far west as the intersection of Penn Avenue and the Memorial Highway and as far north as three blocks from the intersection of the Memorial Highway and 7th Street North, may take as long as five minutes on an 80-second cycle length. The Local Controllers respond to offset changes by the shortest possible route consistent with the motorists safety, never having to compensate more than 50 percent of the way around the dial.

The new system also incorporates several mechanical features which make it versatile and adaptable to future expansion. Among these are the broad range of cycle length selections and versatility within each selection. Fourteen different cycle lengths are available in the system, all of which are utilized. Coupled with each of these cycles, ranging from 40 to 120 seconds, there are four individual selections for splits (percentage of total time cycle assigned at each intersection for "main street" versus "cross street" traffic) and four individual selections for offsets (the relationship of the green signal indications at each intersection with respect to a reference point established by the Master Controller).

The system's present total of sixty-two signal heads are electrically interconnected by a single 12-conductor cable.

Our peak traffic periods occur between the hours of 7 to 9 AM and 4 to 6 PM, as is standard in most metropolitan areas. During these periods, vehicle densities may rise to levels as high as 200 percent over so-called "normal" periods. Even with this high rate of increase, a continuing series of surveys and on-the-scene checks reveals that congestion has been reduced 25 percent of what it had been before the new system was installed. During the heaviest traffic periods, it is now possible to get through the Olson Memorial Highway/7th Street North intersection within one, or not more than two, signal cycles. The minimum previous average at such times was three to four light changes.

The total cost of the new system was $66,000; the equipment amounted to some $26,000, the installation expense, $40,000. We have experienced nothing more than routine maintenance of our system, installed approximately one year ago, even though our year round climate involves a wide fluctuation in temperature and humidity.

Our new "EC" System has achieved a dramatic alleviation of what was rapidly becoming one of our worse traffic problems. It has made the area it controls an efficient through route. Our present plans call for expansion of this system to include several additional intersections . . . all well within the capacity of the equipment. This expansion will expedite traffic to and from the outlying residential districts surrounding the northwestern portion of the city. □□□

Largest Clay Pipe with Compression Joints

Clay pipe being installed in Hoquaim, Wash., is believed to be the largest ever produced with a factory-made compression joint. The pipe sections, which are 42-in. diameter, 5-ft. long and weigh 2800 pounds each, have been manufactured by Gladding, McBean & Co. The Speed Seal compression joint is now available throughout the complete range of clay pipe sizes.

A Question of

Does the annual cost of equipment consist of initial price, plus total maintenance and operational costs, divided by the number of years it retains its efficiency? If you think it does, consider that the average age of our equipment in service is over 10 years . . . with many pieces still efficient after more than 25 years...and it seldom looks its age! Strength . . . long life and low maintenance are "built-in" plus features of everything we make.

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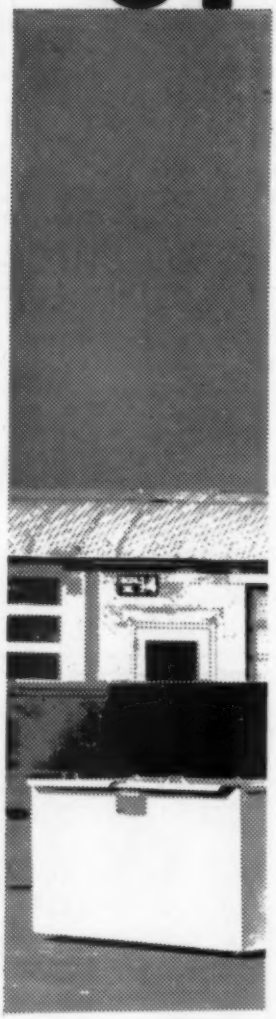
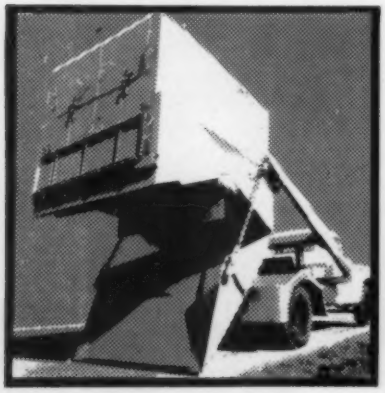


DEMPSTER-DUMPSTER



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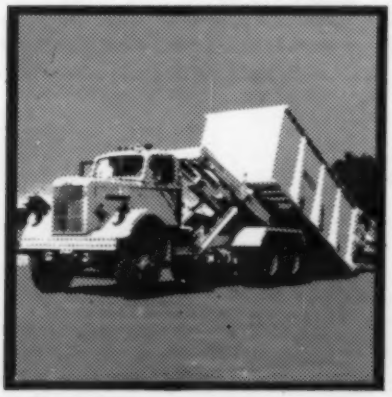

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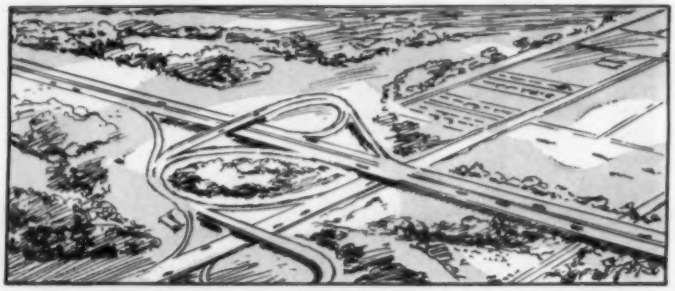


Prepared by **L. G. BYRD,** *Associate Editor*

Dual-Purpose Alley

The City of Odessa, Texas, recently completed construction of an alley which will serve both as an access facility to commercial property and as a drainage channel. The alley was built with invert slopes varying from 10-to-1 to 5-to-1. An 8-inch compacted caliche base was surfaced with 1½ inches of hot-mix, hot-laid asphalt concrete. Curbs were constructed of 2,000-lb. portland cement concrete. Standard size equipment was used successfully in the alley except at the bridge wing wall tie-in points where 3 to 1 slopes required that compaction be obtained by vibrating screeds and self-propelled pneumatic rollers. The City of Odessa feels that there is a definite use for inverted alleys and streets as drainage facilities. The flat slopes and soil and climatic conditions tend to make the use of inverted alleys and streets desirable and economical. No difference in maintenance cost has been found in Odessa between the inverted crown streets and the normal crown streets. Plans for future drainage include the use of more inverted crown streets as an integral part of Odessa's drainage facilities.

"The City of Odessa, Texas Builds Dual-Purpose Alley." By Paul M. West, Director of Public Works, Odessa, Texas. *Asphalt Institute Quarterly,* July, 1961.

County Report

Most of the bituminous surfaced mileage in San Benito County is in the category of single or double chip-seal treatment. These roads are constructed of a gravel base with a thin bituminous wearing surface. One of these roads, now carrying 2,500 vehicles per day, has required almost no maintenance during a 3-year period. Another road completely failed in 7 years while never carrying more than 450 vehicles per day. Obviously the quality of these thin surfaces is no better than the base underneath them. The thin surfacing is a step in a definite stage-construction program for all highways carrying less than 2,500 vehicles per day. San Benito County officials believe that penetration treatments, single and double seals, light armor coats and such thin pavement surfaces are a waste of money unless two factors are present—an adequate base and good drainage. On all county highway construction the soil is first tested by a commercial laboratory to determine its adequacy. Aggregate requirements are then computed by a method developed by the California Division of Highways. The general procedure followed in constructing armor coats includes: 1) Base finished by slurrying with water and rolling. 2) After the base is dry the surface is primed with cutback asphalt and traffic is then permitted to use the primed surface for no less than 3 days before placing the wearing surface. 3) The primed surface is patched to smooth out any breaks and then covered with an application of 200 to 300 penetration asphalt or MC-5 cutback asphalt. A cover material of chips or screenings is then applied at the rate of 100 lbs. per gallon of asphalt binder and rolled using a tandem or pneumatic-tired roller.

"A County Engineer Reports." By E. R. Hanna, County Road Commissioner, San Benito County, Hollister, California. *Better Roads,* July, 1961.

Serving Motorists

When the 41,000-mile Interstate system is completed, motorists' services will fall into two major categories: 1) Emergency services required by motorists because of sickness, accidents, vehicle breakdowns, etc.; and 2) services to meet the normal requirements of motorists such as fuel, automotive service and repairs, comfort stations, restaurants and logging. There have been two surveys which give an indication of what may be expected with respect to motor vehicle breakdowns on Interstate highways. A 34-mile stretch of Interstate Route 75 in Michigan's Genessee County was studied by the County Road Commission. On this roadway, where traffic counts range from 6,000 to 11,000 vehicles per day, the figures on vehicles break-downs during the 7-month observation period were: 57 out of gasoline; 86 flat tires; 66 requiring wrecker service; 61 requiring touring assistance; 8 requiring flares and traffic direction; 8 requiring police or ambulance service; 30 requiring miscel-

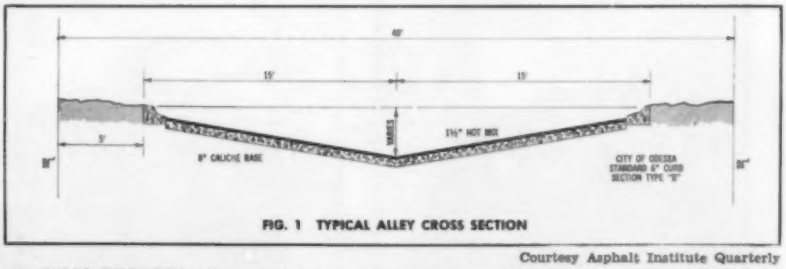


FIG. 1 TYPICAL ALLEY CROSS SECTION

Courtesy Asphalt Institute Quarterly

● **DUAL-PURPOSE alley provides access to commercial properties and also acts as drainage channel. Invert slopes vary according to local conditions; paving is hot mix.**

Michigan Tractor Shovel the key machine

Eastern city perfects unique system for clearing snow from wide streets

At Newburgh, New York, a new system of snow clearance is paying big dividends in taxpayer satisfaction.

Tried and perfected during the record snowstorms of the past two years, the system has solved the problem of efficiently clearing the City's extremely wide main street.

"For the first time," reports Newburgh's Director of Public Works W. G. McEvilly, "we're getting widespread compliments, instead of criticisms, on our snow control."

Push snow to center of street

Under Mr. McEvilly's plan, plowing starts as soon as snow accumulates two inches deep. The 1½ miles of wide main street come first. Speed and mobility of the machine used later for clearing—a Model 125A Michigan Tractor Shovel—enables grader and truck plows to push the snow *to the center* of the 90 ft wide pavement. All lanes are thus cleared quickly for traffic, cars can park normally, and plows push smaller loads than customary. Then, while the trucks and graders plow the other 60 miles of City streets, Newburgh's Michigan moves onto the main highway.

Michigan clears intersections

Working first at each intersection, the 127 hp Michigan quickly pushes the snow into a huge pile (see photo below). In two hours or less, all 15 intersections are clear, and cross-traffic can move freely while the 2¼ yd Michigan then bucket-loads the piled snow. Typical 12 to 14 yard trucks are heaped in 6 passes each. Load time for each truck, about 3 minutes.

Slush is bucket-loaded, snow is blown into trucks

As soon as this piled snow is removed, the Michigan goes to work on the windrows in mid-block. This accumulation too is truck-loaded . . . by bucket when the snow is slushy . . . by quick-mount blower under ordinary conditions. Prime advantages of the blower are *heavier truckloads*—blower chops the snow to eliminate voids . . . and *speed*—with it, the Michigan loads a 14 yard truck in half the time as with bucket, 60 to 90 seconds!

All this work has never taken any longer per snowstorm than three round-the-clock 8-hour shifts! The City's 10 parking lots go almost as fast . . . the Michigan here not only truck-loads the snow by bucket or blower, but often plows and piles it. Efficiency? Counting *all* jobs since purchase in 1958—working 8 hours most days, 5½ days a week *year-round*, plus round-the-clock in snow emergencies—*the Michigan has not lost one single hour of assigned work time!*

Michigan is a registered trademark of
CLARK EQUIPMENT COMPANY
Construction Machinery Division

CLARK EQUIPMENT

2499 Pipestone Road
Benton Harbor 40, Michigan

In Canada:
Canadian Clark, Ltd.
St. Thomas, Ontario

laneous services; the total was 316. An 8-mile stretch of the Baldock Freeway between Salem and Portland, Oregon, carrying some 8,000 vehicles per day in both directions, was studied for a total of 66 hours by the Oregon State Highway Department. Only 29 emergency stops along the freeway were recorded during this period. Five of these stops were due to running out of gasoline. The total number of stops for all reasons was 226, making the 5 out-of-gasoline stops represent only 2 percent of the total. State highway officials recognize the special characteristics of the Interstate system that will require new techniques for dealing with emergencies on the highways. M. D. Christensen, Chief of the Bureau of Public Roads, Construction and Maintenance Division, told highway officials at the 1959 AASHO meeting that effective traffic surveillance methods can help in preventing sudden and large scale build-up of congestion, and roadside communication facilities may be valuable when human lives are at stake at time of emergency or disaster. As a service in locating motorists in distress and in providing communication media for appropriate outside help, principal reliance must be placed upon patrol units. The Bureau of Public Roads feels that state highway department maintenance personnel can also perform useful functions inasmuch as they will be working on the highways within reach of the traveling public and will be called upon frequently to serve motorists in need of information or assistance. Engineering techniques can be adapted by highway designers to help minimize the problems encountered because of motorists break-downs.

Engineering features would include the construction of median crossovers and emergency entrances and exits to the roadway. Charles M. Noble, former Director of the Ohio Department of Highways and former Chief Engineer of the New Jersey Turnpike points out that police, towing, wrecking, ambulance, fire department, roadside gasoline patrol service and maintenance operations require crossovers in the median. Without this flexibility, the effective operation of servicing units will not be feasible to a degree that will be satisfactory to the operational forces and the traveling public. Between interchanges emergency "escape hatches" are required at appropriate locations to care for entry and exit of emergency vehi-

Seal Coating with Cationic Bitumuls produced uniformly fine results in spite of early showers

CATIONIC BITUMULS SPEEDS SEAL COATING IN TACOMA

The City of Tacoma, Washington, has two major sources of street maintenance problems. First, some forty miles of very old (1890-1915) sheet asphalt surfaces. These are now badly cracked and extensively patched. Second, several hundred miles of streets that have only a light bituminous treatment. The ever-increasing traffic load is starting to cause trouble on these.

In the past, the City has settled for continuous patching on the sheet asphalt; and Seal Coating of the light bituminous arterials, using either anionic emulsions or cutbacks. The Seal Coating required closing the streets to traffic for long periods; and weather was a constant threat, restricting the work seasonally.

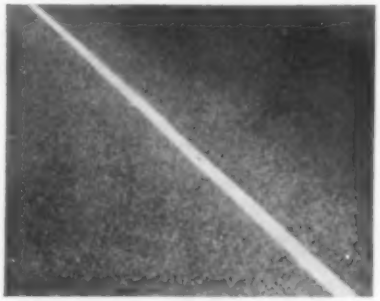
City maintenance forces were quick to see two major advantages of Cationic Bitumuls when it was first introduced. A—This material had a natural affinity for the cover aggregate being used. B—The rapid-setting characteristics sharply reduced the danger of "wash-off" from rain. (When showers actually occurred within two hours of job completion, there was no damage!)

Based on earlier work the City was able to "field" a well-integrated Seal Coating team. Cationic Bitumuls sets rapidly so that Seal Coating operations were co-ordinated even more closely. Both the cover-stone truck and the pneumatic roller could follow very closely behind the distributor!

The Seal Coating operation has now been extended to the "ancient" sheet asphalt pavements. Here it prevents the break-up action that made earlier patching necessary.

Using Cationic Bitumuls, streets are closed to traffic a much shorter time; and the work season begins much earlier in the year.

Discover for yourself the ability of Cationic Bitumuls to extend the work season; and to coat and hold most aggregates—even those normally regarded as "difficult". Bitumuls Engineers in our nearest office will supply full information; and will arrange for you to see a Cationic Bitumuls job in your area.



Close-up view of a Cationic Bitumuls Seal Coat. Note uniform cover-stone retention

cles. For normal motorists' services, the frequency of regular exit and entrance points is of prime importance. Highway officials generally feel that, with proper signing and some experience on the part of motorists, commercial facilities located on private property on feeder roads, at interchanges or on frontage roads will provide adequate services for the users of the new Interstate highways.

"The Problem of Serving the Motorists." *Highway Highlights*, June-July, 1961.

Lowering Culvert Flow Line

To eliminate serious flooding conditions of a two-barrel, 8 x 8-foot, multiple-box culvert crossing U.S. 69 in the City of Port Arthur, Texas, three possible solutions were developed. One alternative was to add to or replace the existing structure by an open cut across the highway. Another alternative was to jack or tunnel a parallel pipe culvert under the highway. The third proposal was to break out and lower the footing of the existing structure. Maintaining the high volume of traffic and providing sheet piling for the excavation required to open cut across the highway, made that alternative prohibitive. Due to the terrain and size and weight of pipe, state forces were not able to handle the jacking operation. Bids were taken for jacking the reinforced concrete pipe under the roadway but were considered unsatisfactory and rejected. The last alternative involving the lowering of the flow line of the existing structure by breaking out the footing was selected and a contract let. The procedure called for the breaking out of the footing in alternate sections, excavating down to required grade, and casting the new footing. One side of the two-barrel box culvert had to remain open at all times to provide for drainage. Total construction and engineering costs amounted to $36,000 which was approximately 50 percent less than the estimated cost of jacking the 72-inch by 200-foot reinforced concrete pipe.

"Lowering Concrete Box Culvert Flow Line." By Cecil E. Norris, Senior Resident Engineer, District 20. *Texas Highways*, June, 1961.

Interchange Design

The construction of the California Freeway and Expressway Systems must be superimposed over a vast

LET MORTON SALT COMPANY SPECIALISTS IN SALT ADVISE YOU WITHOUT COST OR OBLIGATION! Nowadays there are almost as many ways of handling salt as there are companies using it.

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Because of its multiplant operations from coast to coast, Morton Salt Company has gained wide experience in all phases of salt handling. Today Morton maintains a department whose sole function is to advise on salt handling problems. There is no cost or obligation whatsoever for this service.

Just fill out and mail the coupon at right, and you will be contacted soon! Do it now—it may mean considerable savings plus increased efficiency for you!

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network of existing city streets and county roads. The integrated system of city, county and state facilities depends on the proper location and design of interchanges accomplished through the mutual cooperation of the agencies involved. On Interstate work the U. S. Bureau of Public Roads is a participant in the intergovernmental relationships. The California legislature enacted a street and highway code requiring that no city street or county highway may be closed by the construction of a freeway, except pursuant to a freeway agreement between the Department of Public Works and the local jurisdiction. The statute also provides for recognition for the freeway routes and stipulates that no new city street or county road may be connected to a freeway without the State Highway Commission consent. In the U. S. Code for the design of the Interstate system, it is stated that interchanges within urban areas should not be spaced closer than an average of 2 miles; in the suburban sections of urban areas they should average not closer than 4 miles; and in rural sections not closer than 8 miles. The Special Freeway Study and Analysis Committee of the American Association of State Highway Officials recommended in reference to interchange spacing that distribution among several streets rather than concentration on one or two would seem to be preferable provided that space is available and conditions are amenable for proper design of interchange turning roadways and that sufficient length is available along the freeway for proper entrances and exits. Sufficient length along the freeway for installing signing and marking and sufficient length for effecting transition between freeway and street operations are other factors to be considered. Two basic purposes of freeway interchanges are for the transfer of local traffic to and from the freeway and local road systems and for a freeway to freeway type of traffic interchange. In urban areas, the primary considerations are traffic operation and capacity. In rural areas where capacity is not a problem, it is only necessary to balance local traffic service against reasonable cost.

In both rural and urban areas, the overall community interest must be considered. A traffic interchange or series of traffic interchanges on a freeway through a community may affect the traffic pattern of large continuous areas. It follows that the location and spacing of interchanges will be affected by

What size grader do you need?

There's an LW that fits your requirements

Once your grader needs are more or less established, you have an opportunity to specialize on a grader of a particular size. It's possible, in a multi-model line, to get the exact size that's just *big* enough to handle your work . . . just *small* enough to afford good savings in operating costs. Then you're sure of lowest investment for your work assignments.

LeTourneau-Westinghouse graders are available in 7 sizes, with horsepower ratings from 85 to 190, weights from 10¾ to 14 tons. All sizes have constant-mesh transmission; 145 and 190-hp POWER-*Flow*® models have torque converter. A variety of matched attachments increase the work range in each size. Major items are: scarifier, bulldozer blade, push-plate, Ateco rear-mounted ripper, snow removal equipment, Jebco Elegrader and Preco Dial-A-Slope blade control.

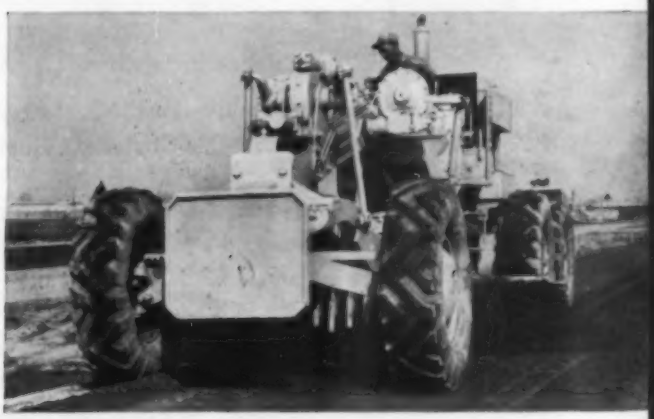
Let your LW Distributor help determine what size of graders will do *your* work most efficiently, cut operating costs, and give you highest return on your grader-investment dollar.

85-hp 330 . . . this economy-priced model has many LW "big-grader" features. Another low-budget LW grader is the 100-hp 330-H.

125-hp 550 . . . heavy-duty all-purpose machine. Choice of GM or Cummins diesel engine, as on all LW graders.

115-hp 440 . . . biggest-value motor grader in this popular size. 8-ft long, 35-in. high dozer-blade is hydraulically controlled from the cab.

160-hp 660 . . . biggest, heaviest grader in the "straight-shift" LeTourneau-Westinghouse line.



145-hp 550 POWER-*Flow* . . . torque converter, infinite speed ranges to 26.4 mph. "550" shown is equipped with Dial-A-Slope blade control. Push-plate and V-type scarifier give it extra job versatility. 660 POWER-*Flow* has 190 hp . . . speeds to 26 mph. G-2395-G-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

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Where quality is a habit

the size of the city and the type of area. In design, each interchange presents an individual problem but primary considerations are traffic and cost. The diamond interchange might be considered the most basic interchange type. The tight-diamond design is most appropriate when the freeway is either depressed or elevated with the cross road remaining at natural ground. The spread-diamond type is usually found in rural areas where the freeway is in the vicinity of natural ground and the cross road is raised over the freeway. Quite often when conditions are such as to justify a four - quadrant cloverleaf interchange the ramp traffic is so large that weaving areas on the freeway are considered objectionable and collector roads must be provided. Another interchange type commonly used is the trumpet design which may be appropriate when a cross road ends at the freeway or where a direct connection to build-up areas is considered justified. The four-level direct interchange may be appropriate in a large metropolitan area where all movements are anticipated to be very heavily traveled. At the present time there are more than 1,000 completed traffic interchanges in operation on the California State Freeway System. In observing the operation of these interchanges it appears that mutual considerations have been successfully met, and that experience in and knowledge of this field is increasing.

"Interchanges, Spacing, Design Must Be Individually Tailored." By W. L. Warren, Engineer of Design. *California Highways and Public Works,* May-June, 1961.

Bituminous Paving

Development of new techniques and new equipment offer increased economy in bituminous concrete pavements if specifications permit their use. Experience in base course construction shows a recent trend toward greater use of vibratory compactors and high pressure pneumatic-tired rollers with a contact pressure range of 80 to 90 psi. The vibratory types are more effective on macadam and clean gravel materials where the percentage of voids is high. Pneumatic rollers do a better job on bituminous concrete, stabilized materials and the gravel-clay types of base courses. The new self-propelled pneumatic tired rollers are adaptable for use on various types of soils and base materials as

well as on bituminous pavements. At least two systems of automatic control of profile and transverse slope are in process of development and field testing. One system is capable of following any of several grade references including a rail, pipe, or steel wire installed parallel to the finished grade just outside the pavement edge. Another system employs an infra-red light source as the reference on tangent grades On vertical curves, the grade can be obtained by offsetting from the tangent grade reference or by one of several programming methods. Several states require a specific number of rollers per tonnage or area of pavement placed per hour. Such requirements do not appear to be always related to the ability of the rollers to produce a dense or smooth surface. The ideal solution would be a set specification based solely on the end result for in-place density and pavement smoothness, with no reference to detailed equipment descriptions for production ceilings.

"Developments in Bituminous Concrete Paving." By H. A. Radzikowski, Chief, Division of Development, U. S. Bureau of Public Roads. *Civil Engineering*, July, 1961.

Other Articles

"How Cincinnati Controls **Snow and Ice.**" Metropolitan transportation in this hilly area demands a fast, efficient winter maintenance program. By Carl B. Gailey, Superintendent, Highway Maintenance Division, Department of Public Works, Cincinnati, Ohio. PUBLIC WORKS, August, 1961.

"A Border State's **Winter Battle.**" Unpredictable weather keeps Delaware crews on the alert during the winter season. By J. H. McWilliams, Jr., Maintenance & Equipment Engineer, Delaware State Highway Department, Dover, Delaware. PUBLIC WORKS, August, 1961.

"Mild **Winters Still Require Planning.**" With an average annual snowfall of only 12 inches, Tacoma must still be prepared to keep traffic moving on steep slopes. By Myron D. Calkins, City Engineer, Tacoma, Washington. PUBLIC WORKS, August, 1961.

"Technical Panel Discusses **Winter Maintenance.**" A timely review of maintenance practices, research activities and testing programs discussed at the CCI Winter Maintenance Forum. PUBLIC WORKS, August, 1961.

"Colorado Keeps the High Roads Open." At elevations above 10,000 feet, blizzards are an expected part of the **winter battle**. PUBLIC WORKS, August, 1961.

"California Roadsides—3." The third in a series of articles on **landscaping and roadside maintenance.** California Highways and Public Works. May-June, 1961.

"Vehicle Detection for **Traffic Analysis** and Control." By Richard C. Hopkins, Chief, Instrumentation Branch, Traffic Operations Division, U. S. Bureau of Public Roads. Traffic Engineering, July, 1961.

"Glassware Breakage—A **Lighting Maintenance** Problem." How adequately-designed luminaires, properly installed and maintained, can reduce the serious problem of glassware breakage. By A. H. Ruling, Specialist-Product Service, General Electric Company. PUBLIC WORKS, August, 1961.

"Congested Urban Area Benefits from Re-Routing and **Modern Sign Techniques.**" By Paul T. Vermillion, Chief, Division of Traffic, Indiana State Highway Commission. Better Roads, July, 1961.

"Stretch the Road Dollar in Township Work." Base reconstruction and **stabilization** save excess blading costs and aggregate loss on township roads. By James Miller, Chairman, Board of Supervisors, and Road Master, Independence Township, Beaver County, Pennsylvania. PUBLIC WORKS, August, 1961.

"**Transitions** from Undivided to Divided Sections of Highways." By Phillip L. Wilson, Senior Designing Engineer. Texas Highways, July.

NEW! PUSH-OUT BODY by HOBBS HYD-PAK

See it at the APWA Show in Minneapolis!

Packs tighter, works economically, unloads anywhere!

Now, Hobbs Hyd-Pak brings you a new kind of refuse collection body. Instead of dumping its load, the new push-out body remains level and its 12½-foot long telescoping hydraulic cylinder expels the load through the rear door opening. Advantages? The big cylinder applies 111,820 pounds total packing force! And the push-out body can unload safely anywhere—on soft land fill or uneven terrain, and with an overhead clearance of only 10 feet. With one cylinder doing all the work of packing and unloading, the operation is simplified, and thus more economical.

"60 SERIES" DUMP BODY

CONTAINER SYSTEM

This new 21-yard body makes the Hobbs Hyd-Pak line of refuse collection bodies more complete than ever before. With a complete range of sizes from 13- to 24-yard "60 Series" dump units, an efficient, sanitary container system and a complete trailer line (from 32-yard single axle models to 60-yard tandems), Hobbs Hyd-Pak offers you modern, low-cost equipment for every kind of refuse removal job.

TANDEM HYD-PAK TRAILER

See all this equipment in operation at the APWA Equipment Show in Minneapolis, Sept. 24-27. Or contact Ted Walters at the address below to set up a free demonstration:

1-9-1

Hobbs Hyd-Pak Division
Hobbs Trailers
609 North Main
Fort Worth, Texas

HOBBS HYD-PAK

Helicopter Airlift Saves Construction Time

By airlifting 15,000 lbs. of building material, including the lumber for its own heliport, a Hiller 12E light utility helicopter recently chopped two weeks off the construction of a permanent stream-flow measuring station for the Surface Water Branch of the United States Geological Survey. The construction took place at the bottom of a 2,000-foot, densely wooded canyon on the South Fork Feather River at the mile-high level of the California Sierra Nevada.

Airlift of the seven and one-half tons of equipment was accomplished in three hours. Hauling the concrete mix and other materials by mule train, the only other method of transport over such difficult terrain, would have taken more than two weeks.

Winter maintenance and periodic readings at the inaccessible measuring stations also are accomplished by the use of Hiller 12E's.

• • •

New Lamp for Floodlighting Largest and Most Powerful

The nation's largest and most powerful light source for general floodlighting purposes is General Electric's 6000 - watt combined mercury - fluorescent tubular light source, five feet long and four inches in diameter. A mercury arc tube, one inch in diameter, extends the length of the lamp. This produces high intensity light, which is improved in color quality by the phosphor on the outer casings. The lamp produces 330,000 lumens, an amount equal to the light produced by nearly four hundred 60-watt household incandescent bulbs. It has an operating life of around 4000 hours.

In appearance the lamp resembles a portly fluorescent lamp, with mogul bi-post bases at either end of the four-inch hard-glass tube. Even though both the glass tube and phosphor are heat resistant, the lamp must be protected from the elements. It is expected that blower cooling will be required to limit the lamp's temperature to below 700°F.

GE's Outdoor Lighting Department has made several experimental fixtures utilizing the 6000-watt lamp One of them, mounted at a height of 60 feet, provides illumination of five footcandles—"whiteway" brilliance—over an entire acre of land.

Texas Interstate 35E, Stemmons Freeway out of Dallas.

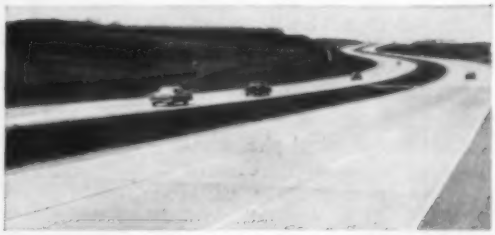
Texas' 352 miles of Interstate awarded to CONCRETE promise big savings in upkeep!

Across Texas, modern concrete highways grow in length—a public reminder of the skills and dedication of the engineers and builders who are creating them.

A solid future is built right into roads like these. Only concrete enables engineers to design pavements to last 50 years and more.

Concrete isn't flexible, so there are no "moving parts" in it to cause hidden wear. And even with the highest temperatures, it won't soften and ripple under traffic. Concrete actually grows stronger year by year.

All these advantages mean extra thrift for Texas as it builds with concrete: Exceptional pavement life . . . upkeep costs that run far less than for asphalt. It's for reasons like these that most Interstate mileage across the nation today is going to concrete.



Texas Interstate 20, Dallas—Ft. Worth Turnpike.

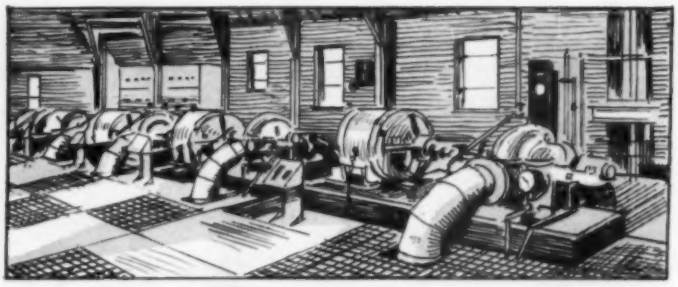
38% maintenance saving with concrete, Texas' 31-year records show!

Official Texas State Highway Department records give the facts: Since 1929, road maintenance costs per mile per year for concrete have averaged $144.68; for asphalt, $235.23. Texas' new concrete highways will do even better!

PORTLAND CEMENT ASSOCIATION

A national organization to improve and extend the uses of concrete

THE WATER WORKS DIGEST



Prepared by **ALVIN R. JACOBSON, Ph. D.**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Behavior of Nuclides

A study of the ion-exchange decontamination system for the recirculating cooling water of the low-intensity test reactor (Oak Ridge) revealed that in the cation, anion, and mixed-bed columns, the concentration of radionuclides on the resin decreased with increasing bed depth. At the same time, the overall half-life of the retained materials simultaneously increased. As anticipated, considerable variation with depth was observed in relative radio-nuclide composition—the shorter lived materials predominating near the surface, the longer lived near the bottom of each column. As a general rule, it can be anticipated that the removal efficiency of an ion-exchange column will be least for those radionuclides whose half-lives are long in comparison to their retention time. And the break-through of these radionuclides may be significant some time before column saturation, as indicated by the removal of accompanying shorter-lived materials. It must be emphasized that this variation in removal efficiency with half-life is not related to the chemistry of the radionuclides but is a physical phenomenon. Some of the concepts evolved from this study may have equal implications in the evaluation of the use of the cation-exchange capacity of the soil for the disposal of radioactive wastes.

"Behavior of Radionuclides on Ion-Exchange Resins." By Dade W. Moeller, Chief, Radiological Health Training Activities, Div. of Radiological Health, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio; George W. Leddicotte, Leader, Nuclear Analyses Group, Analytical Chemistry Div., Oak Ridge National Lab., Oak Ridge. Tenn.; and Sam A. Reynolds, Leader, Radiochemical Research & Development Group, Analytical Chemistry Div., Oak Ridge National Lab., Oak Ridge, Tenn. *Journal AWWA.*, July, 1961.

Trends In Water Consumption

The editors of PUBLIC WORKS have conducted questionnaire studies in 1959, 1960 and 1961 in an effort to update information on municipal use and current trends toward increasing rates of water consumption. These data have also been compared with a similar but restricted survey made in 1956 and published in the December issue of Public Works in that year. The recently completed study showed: The average use in 1950 was reported as 107.7 gpcd; the 1960 use was reported as 134 gpcd; and the estimated 1970 use is 158 gpcd. The 1956 study reported somewhat higher usage on a national basis than the 1960-61 study. Restrictions on water usage were reported by only 54 cities of the 465 cities whose data was used in this study; most of these restricted water use by air conditioners. In the 1959 questionnaire, information was obtained from 114 cities on average and maximum rates of water consumption in gallons per hour. A summary of this information is compared with similar data obtained from the 1960 questionnaire survey. The current average water use was 5.9 gallons per capita per hour; that for 1950 was 4.5; and that predicted for 1970 was 6.6. The 1956 study gave as peak hourly usage 10.8 gals. per capita in 1936, 12.6 gals. in 1946,

Standby Power for Water Department

● **WATER Superintendent T. L. Rhodes of Vidalia, Ga., is shown here with an IHC engine installed as an emergency power unit in case of power failure. When needed, the engine will drive a 2,400-gpm Peerless pump, enough to meet normal needs. Vidalia consumes about 2.5 mgd during summer months. The water is from wells.**

EDDY New Improved Products Meet Modern Needs

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- **Improved, streamlined, modernized**
- **Optional break-flange**
- **Large diameter barrel**
- **New self-sealing main valve packing**
- **Requires no lubrication**
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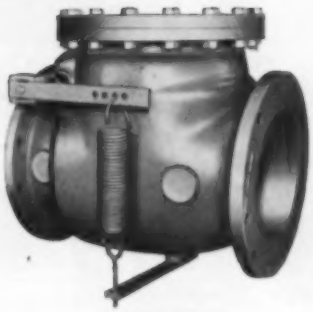
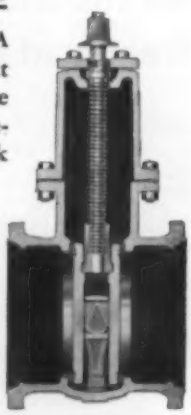


EDDY Check Valves

Completely new designs of horizontal swing check valves are available in sizes from 4 through 12 inches. They operate dependably in either vertical or horizontal positions and incorporate construction features which provide unusual flexibility of operation. These valves may be converted in the field from plain to single- or double-lever operation to meet changing requirements. Other check valves up to 24 inches.

EDDY Gate Valves

In addition to the regular line of EDDY Taper Seat AWWA gate valves, EDDY now offers a newly designed parallel seat AWWA gate valve in sizes through 12 inches. This valve has been specifically engineered to provide long, trouble-free service. Working parts are designed with heavy, thick section and large seating surfaces for dependable operation and improved wearing qualities. The valve has two-point, free-floating wedging for minimum friction and maximum operating ease. Other AWWA gate valves are available through 48 inches.



Whatever your waterworks requirements, it will pay you to have full information on the complete EDDY *line of valves and hydrants.*

EDDY VALVE COMPANY
A Subsidiary of James B. Clow & Sons, Inc.
WATERFORD NEW YORK

15.9 gals. in 1956, 17.8 gals. in 1960 and 19.0 gals. in 1976. A table showing average water usage per person per day in 32 selected cities is included in this article.

"Trends In Water Consumption." PUBLIC WORKS, August, 1961.

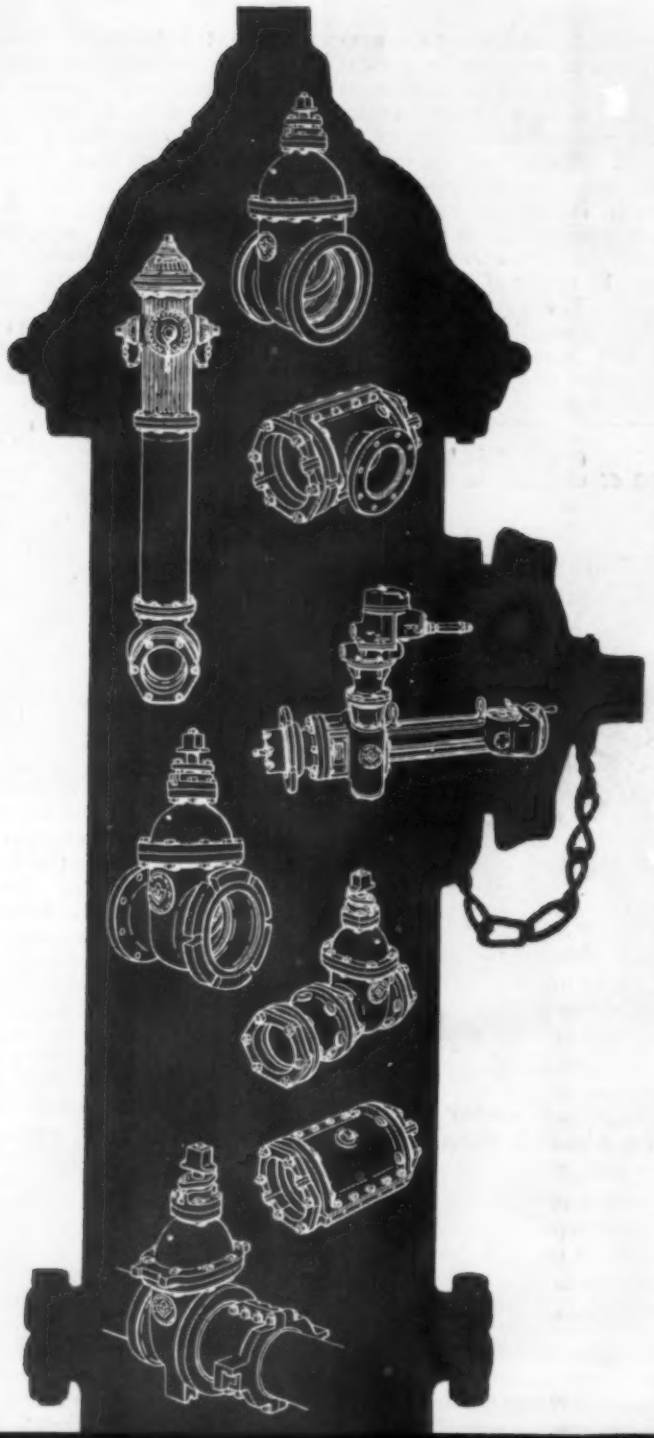
Water Disinfection

In this article the author presents a comprehensive discussion of chlorination of water. The principal objectives of chlorination are to destroy pathogenic organisms that may be present in the water or which may enter the water in the distribution system through cross-connections. Another reason for chlorination is to destroy the coliform or other organisms used as an index of pollution. An excess amount of chlorine is added to satisfy the chlorine demand of the water, to provide a residual which will act as a safety factor against subsequent bacterial contamination. Chlorine may be added as a gas or as the hypochlorite of sodium or calcium; the type of residual formed is the same from either source. Chlorine may be present as free chlorine or as chloramines, the former being a more efficient bactericidal agent than the latter. Methods and equipment for feeding chlorine, together with the precautions which must be observed to protect personnel, are discussed in some detail. Variations in dosage and cost of chlorination are also mentioned briefly.

"Disinfection de l'Eau" (Disinfection of water). Par C. Gomella, Directeur de la Societe d'Etudes pour le Traitement el l' Utilization des Eaux (S.E.T.U.D.E.). *Techniques et Sciences Municipales*, Mai, 1961. (9, rue de Phalsbourg, Paris-17e, France).

Chlorine Leak Detection System

When the City of Seattle water department in 1957-58 engaged in an extensive program to provide gas chlorination facilities at the 10 storage reservoirs in the distribution system it was determined that some form of alarm would be installed which would detect the presence of chlorine gas due to leaks and actuate an external alarm. This ingenious alarm system was essential due to the large quantities of chlorine being fed, necessitating the use of ton containers of chlorine in and near areas of high population density. The water department pur-



For

HYDRANTS

For over half a century Smith Hydrants have performed faithfully — 24 hours a day — in cities large and small throughout the country. In New York, Providence, Philadelphia, Detroit, Baltimore, Toronto, St. Louis, Washington, D. C. and in many other cities Smith-designed hydrants have been adopted as standard.

VALVES

Smith metropolitan specification Gate Valves are produced in sizes 2" through 48" with all standard types of end connections for low, intermediate and high pressure service and are manual, cylinder or electric motor operated. Overall Valve size range is 2" through 66"

TAPPING SLEEVES, VALVES & MACHINES

In 1896 Smith introduced the Tapping Machine which revolutionized the making of 2" and larger connections (under pressure) to fluid and gas service piping, storage tanks, etc. The machines are used with Tapping Sleeves, Hat Flanges, Saddles and Tapping Valves to make pressure connections to Cast Iron, Cement-Asbestos, Steel and Reinforced Concrete piping. Overall size range 2" through 42".

CUT-IN VALVES & SLEEVES

Most economical way of installing additional or replacement Gate Valves (sizes 4" to 12") in existing piping which can be relieved of pressure.

REPAIR SLEEVES

Used to permanently repair and quickly return broken or cracked piping to service. Sizes 4" through 48".

INSERTING VALVES & MACHINES

Used to install under pressure additional Valves in existing water and gas service piping which **cannot** be relieved of pressure — size range 4" through 48".

LEADERS IN THE WATER WORKS FIELD SINCE — 1896

HYDRANTS — VALVES

THE A.P. SMITH MFG. CO.

SINCE 1896

EAST ORANGE NEW JERSEY

71

chased five Solvay chlorine detectors and five Hammarlund tone signal transmitters and receivers. A detector and tone transmitter was installed at each of the five larger reservoir chlorination stations and the five tone receivers were mounted in a custom-built cabinet and installed at the water department shops which are manned continuously. Rented telephone lines from the reservoirs and pump stations terminate at the control center. It is over these lines that the tone signals from the five chlorination stations having alarm equipment are transmitted to receivers at the control center. At each station the detectors are mounted in the chlorine tank room and are designed to detect the presence of chlorine gas in the air and give a visual alarm when the chlorine concentration reaches 3 ppm in the atmosphere. A continuous sample of air is maintained through the test chamber of the detector by means of a blower. The presence of chlorine is detected through its reaction with a sensitized test paper within the test chamber and this reaction activates a visual alarm. In the event of an alarm, the telephone switchboard operator immediately contacts the water treatment foreman, who is provided with a radio-equipped automobile containing a gas mask, tools and spare parts necessary to make most repairs. Solvay emergency kits for stopping chlorine leaks in chlorine tanks or piping are always available. Emergency Chemox oxygen breathing apparatus are available where the chlorine concentration is too high to use the canister-type mask with which all water treatment personnel are equipped.

" 'Watchdog' System Detects Chlorine Leaks at Seattle." By E. J. Allen, Asst. Supt. of Water and Norman R. Angvik, Water Treatment Foreman, Seattle, Wash., Water Department. *Water Works Engineering*, July, 1961.

Ground Water Replenishment

In 1954 the Orange County Water District instituted a large-scale ground water replenishment program. In the past 15 months, approximately 200,000 acre-feet of water was brought 275 mi. from the Colorado River into the district through the aqueduct system of the Metropolitan Water District of Southern California (MWD). The district paid approximately $2,400,000 for this water through revenue derived by the two following methods: One-third of the money was obtained by an ad valorem tax on all real property within the district and two-thirds was collected through a replenishment assessment levied by the district on all water produced from the ground water supply and paid by those who pumped the water. During the first few years of operation of the program the ad valorem tax was restricted to a top limit of 15 cents per $100 of assessed valuation. This rate has recently been reduced to 8 cents. The replenishment rate levied for the first fiscal year of operation (1954-55) was $3.50/acre-foot of water produced. This rate has been raised several times and was set at $5.50/acre-foot in 1960. In operation, the replenishment program of the district consists of three major steps: 1) The district ascertains from an engineering investigation and report the probable overdraft on the district basin in the ensuing year; 2) on the basis of the engineering report, the district levies the assessment to provide funds for the purchase of imported

10 Foot View Of 26,050 Foot Water Line

A little bulldozer was used to good advantage on this 48-inch five-mile water supply line in Columbus, Ohio. The first job it did for the Complete General Contracting Company of Columbus was to level the bottom of the trench and prepare a bed for the pipe.

After the crane lowered the pipe, a workman placed blocking in the bell and the little dozer shoved the pipe home as shown in the picture at the top of the page. The line was installed under the direction of Ernest H. Stork, Director, Department of Public Service and Frank Wright, Superintendent, Division of Water, Columbus, Ohio.

On other parts of the job, a backhoe was used to dig the trench, place the pipe and shove the joint home. Burgess & Niple of Columbus were consulting engineers. The pipe was manufactured by Price Brothers Company, Hattiesburg, Mississippi and Dayton, Ohio.

Price Brothers

CONCRETE PRESSURE PIPE

water; 3) the district buys water that originates outside the district, imports it to the spreading grounds, and adds it to the ground supplies. The district owns 800 acres of land for use as spreading grounds. The largest is 725 acres in the Santa Ana River Channel, which overlies the recharge portion of the district basin. Another site consists of 25 acres, portions of which have been excavated to a depth of 20 ft. and is currently in use for replenishment. Another site, 65 acres, will be ready for use this year.

"Ground Water Replenishment in Orange County, Calif." By Howard W. Crooke, Secy.-Mgr., Orange County Water Dist., Santa Ana, Calif. *Journal AWWA*, July, 1961.

Study of Color and Iron Removal

The Town of Amesbury, Mass., has been obtaining its water supply since 1911 from a tubular well field in the valley of the Powow River at a location known as Rings Corner. By 1926, the iron content had increased in this well supply to a concentration necessitating the construction of an iron and manganese removal plant. This plant, built in 1927 at a cost of $85,000, reduced the iron content from 5.7 ppm to about 0.13 ppm, a reduction of about 98 percent. This plant has provided for iron removal by aeration, filtration through a coke bed, plain sedimentation and slow sand filtration. However, after the first 6 years of satisfactory operation, the efficiency of the iron removal deteriorated to the point where filter runs were short, consumer complaints were not uncommon and in general the plant was doing an entirely unsatisfactory job at certain times of the year. A research program was carried out to find a suitable iron and manganese removal method. A pilot plant was utilized, supplemented by jar tests, in determining the most effective method of treatment. Alum was found to be an unsatisfactory coagulant. With chlorine as an oxidizing agent and lime added for pH control, a treated well water was produced after flocculation, sedimentation and rapid sand filtration with iron content consistently below 0.05 ppm, no manganese and a color about 5 ppm.

"Study of Color and Iron Removal by Means of Pilot Plant at Amesbury." By Robert A. McCracken, Senior Sanitary Engineer, Mass. Dept. of Health, Boston, Mass. *Journal of the New England Water Works Association*, June, 1961.

Other Articles

"Fighting Lake Weeds with a Chemical Spray." Chautauqua Lake being rid of nuisance weeds by means of sodium arsenite. By Robert Dyment, PUBLIC WORKS, August, 1961.

"Suggested Method for Turbidimetric **Determination of Sulfate** in Water." An investigation of some of the variables in the turbidimetric procedure in the 11th edition of "Standards Methods" resulting in a significantly improved procedure being developed. By John R. Rossum, San. Engr. and Primo A. Villarruz, Asst. San. Engr.; both of California Water Service Co., San Jose, Calif. Journal AWWA., July, 1961.

"What Happens When People Replace Potato Patches?" A Long Island water system faced pressure, corrosion, storage, pumping and distribution problems as its area exploded from farm acreage to new metropolis. By R. G. Holzmacher, Henry G. Holzmacher and Associates, Consulting Engineers. Wastes Engineering, July, 1961.

"Waterworks Rating Formula Intended to Spread Burden." The new method of assessment brings into the calculation the average yearly quantity of water supplied, the intention being that rating assessments should be equalized over a number of years by reference to a national factor, at present calculated as between £11 and £13 (about $31 to $36) per million gallons. By Kenneth M. Hepburn, F.C.A., General Manager and Secretary, East Surrey Water Co., speaking at British Waterworks Association Conference. The Surveyor and Municipal and County Engineer. 1 July, 1961. (42, Russell Square, London, WC1).

NEWS OF ENGINEERS

DONALD M. DITMARS and DAVID W. CARMICHAEL have formed the consulting engineering firm of Ditmars & Carmichael, with offices at 20 Nassau St., Princeton, N. J.

DANIEL J. SAUNDERS, long time vice-president of Permutit Division of Pfaudler-Permutit, Inc., has opened an office at 70 Pine St., New York 5, N. Y., and is available as consultant or co-consultant with respect to water conditioning for any purpose; and also for investigative work and other services in the water field.

Prof. ROLAND B. GREELEY has been appointed director of admissions at Massachusetts Institute of Technology succeeding Prof. A. B. THRESHER who had held the post for the past 25 years.

SEYMOUR ZUBKOFF, recently of the DeLong Corporation, is now a principal engineer on the staff of the Hydrotechnic Corporation, hydraulic and sanitary engineers of New York City. In his new position, Mr. Zubkoff is currently assigned to Hydrotechnic's office in Saigon, Vietnam, in connection with the firm's engineering work for the new Saigon-Cholon Metropolitan Water Supply project for the Government of Vietnam.

JOHN E. EVERSON has been elected to partnership in the consulting engineering firm of Parsons, Brinckerhoff, Quade & Douglas, New York City; JOHN O. BICKEL has retired but will continue as a consultant.

CHARLES H. CALLISON has been appointed to the Water Pollution Control Advisory Board. Mr. Callison is assistant to the president of the National Audubon Society.

The Ohio River Valley Water Sanitation Commission, Cincinnati, Ohio, has elected officers for the coming year as follows: Dr. C. L. WILBAR, Jr., Chairman; BERN

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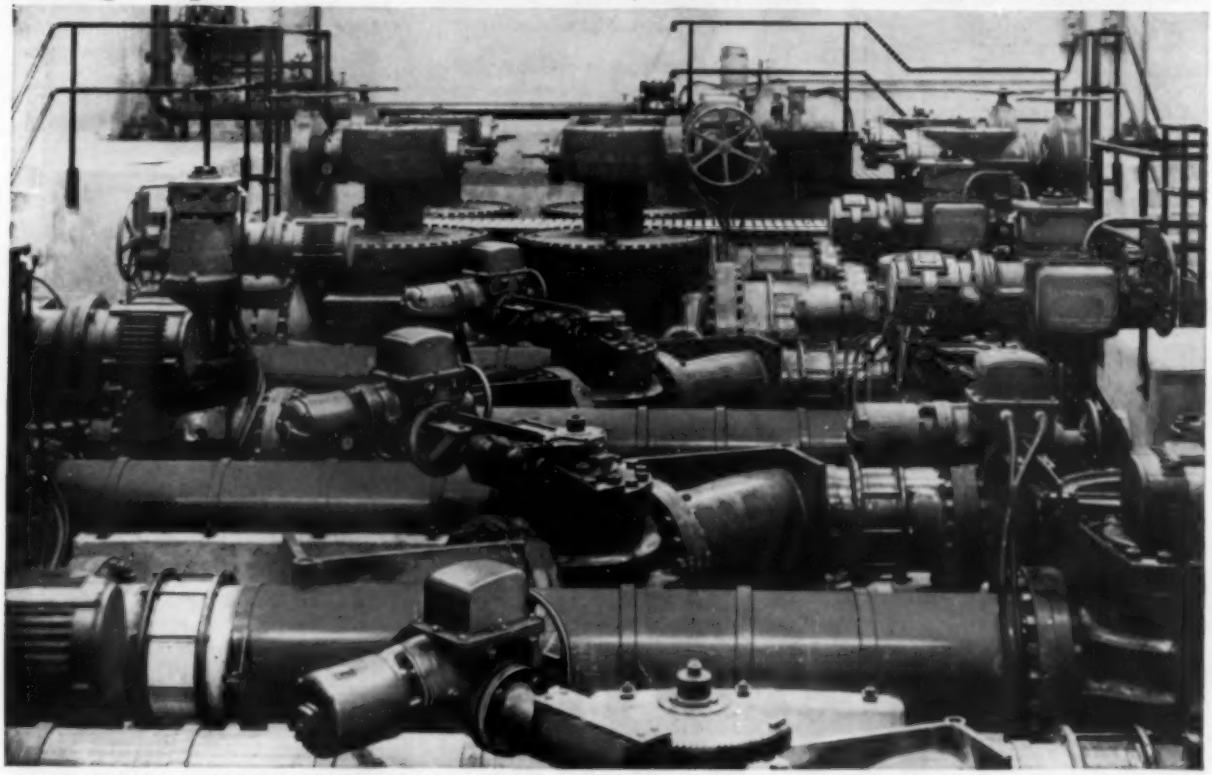

COVINA PRESSURE REGULATING STRUCTURE
. . . one of several such structures in a distribution system supplying water to 7,500,000 people in 91 cities

Be sure to send for Bulletins #1-60 and #19-60 which illustrate and describe the construction, operation and installation of LimiTorque.

This huge water system, selected by the American Society of Civil Engineers as one of the "Engineering Wonders of the World" and operated by the Metropolitan Water District of Southern California, supplies water to 7,500,000 people in 91 incorporated cities over an area of 3,400 square miles in six counties . . . It was built at a cost of approximately $400,000,000 and has the capacity to deliver 1,212,000 acre-feet of water annually. Its intake is on Lake Havasu formed by Parker Dam on the Colorado River, 300 miles from the City of Los Angeles. Many hundreds of LimiTorque Operators are used on all types of Gate, Globe, Butterfly, Plug and Cone Valves throughout this tremendous water system . . . Twenty-two LimiTorque Valve Controls alone are used in this Pressure Regulating Structure, for operating Plug and Cone Valves made by well-known manufacturers.

LimiTorque Operators were chosen because of their accuracy, safety, absolute dependability, and ease of push-button control from local or remote locations.

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PRECISION GEARS • INDUSTRIAL GEARS • SPEED REDUCERS • FLUID MIXERS • FLEXIBLE COUPLINGS
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WRIGHT, vice-chairman; F. H. WARING, Secretary; and E. J. CLEARY, executive director and chief engineer.

CLYDE L. PALMER, City Engineer of Detroit, Mich., has been elected president of the Detroit Engineering Society, the largest (5,800 members) local engineering society in the world.

CLINTON L. BOGERT has retired from Clinton Bogert Engineers, New York, Hackensack, N. J., and South Norwalk, Conn., but will act as consultant to the firm. Work of the firm will be continued by the remaining partners who are I. L. BOGERT, R. A. LINCOLN, C. A. MANGANARD and WILLIAM MARTIN.

EDWARD DEPINA is now regional manager for the Albany, N. Y., office of John Clarkeson, consulting engineer, Boston, Mass.

ROY B. EVERSON, president of the Everson Mfg. Co., Chicago, and long time active in swimming pool sanitation and water treatment, died recently.

GORDON L. E. LINN of the Duhernal Water Co., Parlin, is the new chairman of the New Jersey Section, AWWA. HAROLD L. GUNTHER, North Jersey Water Supply Commission, is vice-chairman; and CHARLES G. BOURGIN, East Orange Water Dept., is the Section National Director. A. J. GRACE and A. P. McCONVILLE are 2-year trustees; and A. F. PLEIBEL is secretary-treasurer for the sixth time.

T. E. EAGAN, chief metallurgist of the Cooper-Bessemer Corp., Mt. Vernon, Ohio, has received the Award of Merit of the ASTM.

DR. HAROLD E. ORFORD, Professor of Sanitation at Rutgers University, died July 10 after a long illness. He had been at Rutgers since 1938.

RICHARD A. OVERMEYER, formerly in charge of traffic engineering for the city of Philadelphia, has been appointed General Manager of the Vehicle Traffic Division of General Railway Signal Co.

• • •

Electronic Plotting Machine Draws Highway Cross Sections

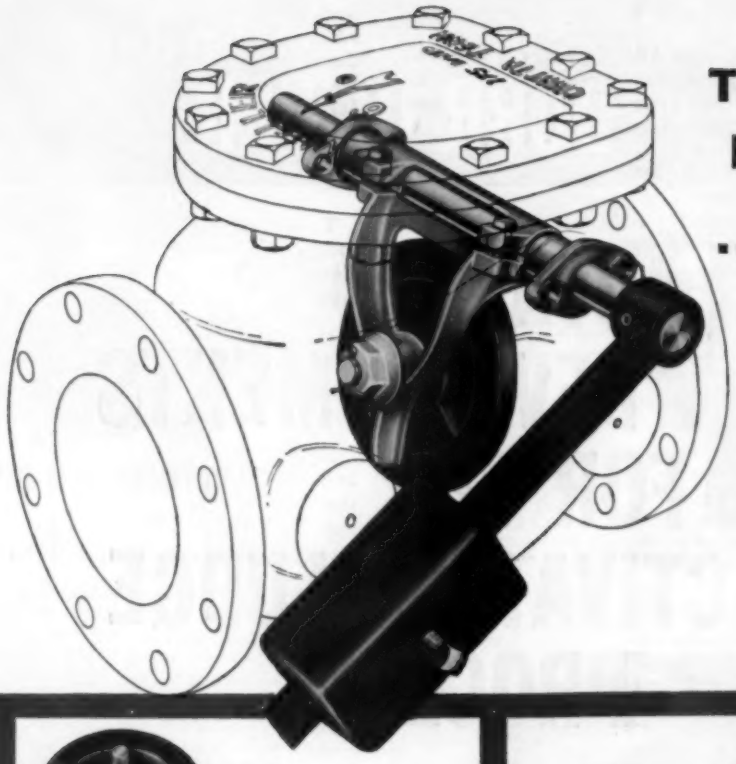
An electronic plotting machine is doing the work of a staff of draftsmen by automatically preparing large quantities of highway cross-section drawings for new road projects.

The first professional engineering firm to turn this drafting-board work over to electronics is King & Gavaris of New York City, consulting engineers on state and Federal highway projects. The firm uses a model 3300 Dataplotter, designed by Electronic Associates, Inc., Long Branch, N. J., to prepare cross-section drawings for every 50 feet of planned highway, a standard requirement on such new construction projects.

In a normal working day, the plotter will do the equivalent work of half a dozen draftsmen preparing the drawings on 30-by-30-inch sheets of graph paper.

All the data normally prepared for cross-section draftsmen is prepared instead by an electronic computer on punched paper tape which serves to instruct the plotter in its job of preparing the large volume of drawings automatically.

David Carsen, the firm's chief engineer, said the machine will turn out more than 400 cross-section drawings in a normal working day. In addition, Mr. Carsen said the firm also has developed a system for using the plotter to plot vertical highway profiles and horizontal traverse surveys.



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Compare the parts of a Mueller heavy-duty Check Valve with those of conventional check valves. In each comparison, Mueller parts are either larger, more accurately manufactured or of higher strength materials.

The result is longer service life and more dependable operation without maintenance.

The Heavy-duty Check Valve is typical of the extra care, extra quality built into every Mueller product.

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Results of a continuing research program by **DORR-OLIVER**

4 ADVANCED DEVELOPMENTS FOR THE ACTIVATED SLUDGE PROCESS

As important results of a continuing sanitary research program, Dorr-Oliver® now presents four major contributions towards improving the efficiency and simplifying the operation of the activated sludge process.

These advances began as research and development projects and have emerged as tested and proved full scale installations. They climax almost ten years of effort aimed at producing a complete line of aeration and clarification equipment.

They offer the consultant or sanitary engineer new opportunities for more efficient sewage plant design, together with maximum flexibility in meeting particular needs.

Complete technical information and convincing records of operation in several installations are available. In addition, the knowledge and experience of Dorr-Oliver engineers, gained in handling every type of sewage and waste treatment problem, are at your service. Write Dorr-Oliver Incorporated, Stamford, Connecticut – or use the convenient coupon at right.

THE D-O INKA AERATION SYSTEM

A unique new design concept

Based on a new principle of operation utilizing large volumes of low pressure air supplied by simple, low-cost ventilating-type fans, the D-O INKA System provides high oxygen absorption rates, high circulating velocities and optimum mixing conditions. Clog-resistant aeration grids are of an entirely new design. The result is an outstandingly simple system with exceedingly low maintenance and power costs.

THE DORR-OLIVER SPIROVORTEX® SYSTEM

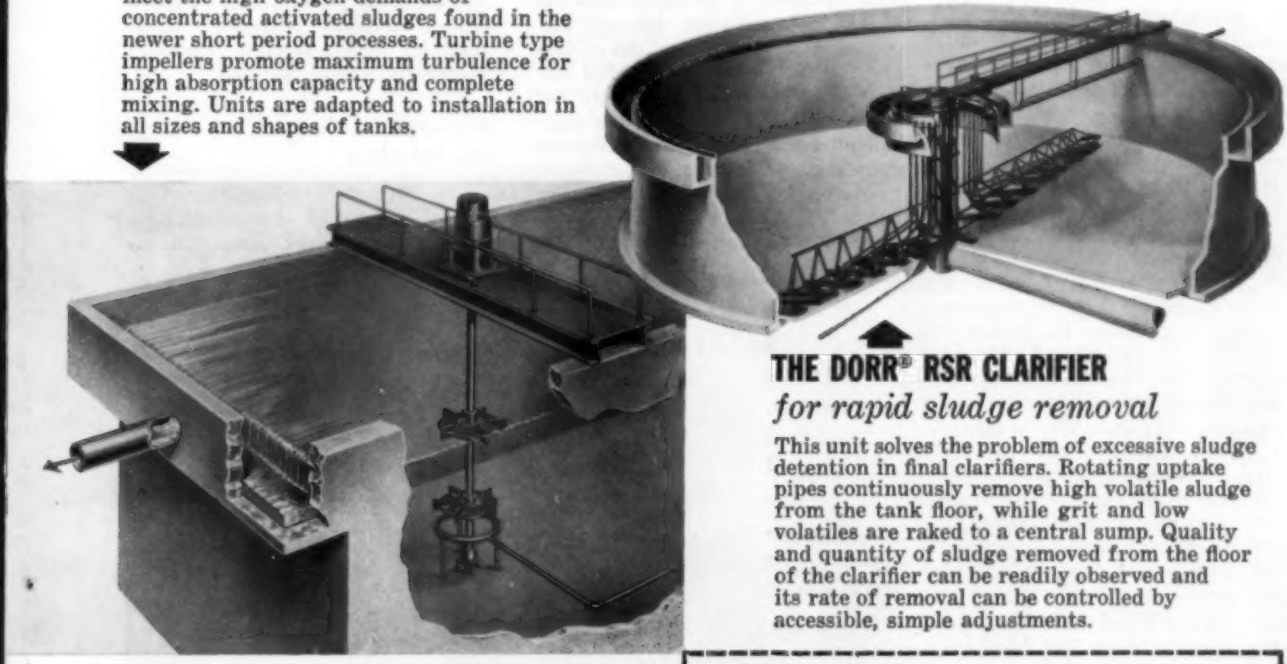
High purification with maximum simplicity

This system combines the simplicity of Biofiltration® with the efficiency of activated sludge treatment. Basic units comprise two SpiroVortex mixing tanks for contacting activated sludge with settled sewage, the Dorr-Oliver-designed SUPERATE® Distributor and Filter and primary and secondary clarifiers. The SpiroVortex system provides an excellent settling sludge and is capable of purification in excess of 90%.

THE D-O® AERATOR

A proven method for meeting increased oxygen demands

The D-O Aerator is a high capacity, motor driven mixing unit specifically designed to meet the high oxygen demands of concentrated activated sludges found in the newer short period processes. Turbine type impellers promote maximum turbulence for high absorption capacity and complete mixing. Units are adapted to installation in all sizes and shapes of tanks.



THE DORR® RSR CLARIFIER

for rapid sludge removal

This unit solves the problem of excessive sludge detention in final clarifiers. Rotating uptake pipes continuously remove high volatile sludge from the tank floor, while grit and low volatiles are raked to a central sump. Quality and quantity of sludge removed from the floor of the clarifier can be readily observed and its rate of removal can be controlled by accessible, simple adjustments.

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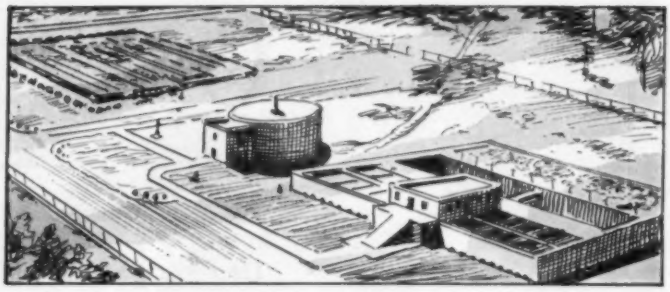
THE SEWERAGE AND REFUSE DIGEST



Prepared by **ALVIN R. JACOBSON, Ph.D.**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Unit Costs of Sewage Works

The factors influencing the costs of design and construction of the various units of sewage treatment works were discussed by the author at the Brighton conference of the Institute of Sewage Purification. In recent years, inflation, lack of competition resulting from governmental economic policies and increased labor costs have all affected these costs; however, these matters are largely outside the control of the engineer. Factors to be taken into account by the engineer in the design which may play a large part in the determination of the final cost of the treatment works are: 1) Selection of the site and 2) selection of the individual units of sewage treatment, i.e., settling tanks, filters and sludge digestion and drying equipment and the degree of mechanization desired to reduce the overall operating costs due to labor. The author discusses the various factors influencing the unit costs and makes a comparison between unit costs at various plants in England. Size of units, materials of construction, type and degree of treatment, amount of excavation required, etc., all influence the cost of the various units. The best results are undoubtedly achieved by very close collaboration between the manager of the treatment works and the designing engineer.

"Wide Variations In Unit Costs of Sewage Works." John Calvert's Analysis at Institute of Sewage Purification conference. *The Surveyor and Municipal and County Engineer,* 1 July, 1961.

Composting System in Toulouse

The Prat system of composting developed about five years ago in Toulouse, is being installed in several towns in France. Refuse is discharged by the vehicles onto the ground next to the fermentation building, then fed into fermentation cells by a tractor shovel without being sorted. Provision is made for aeration in the fermentation cells under controlled temperature conditions. During the fermentation process a solution of sodium sulfate and calcium carbonate is added under controlled conditions to aid the maintenance of the optimum carbon-nitrogen relationship, moisture content and pH value. The material is fed into a hopper at the intake end of a conditioning plant from where it is discharged onto a conveyor which passes over a drum magnet which removes tin and other metals for salvage. Complete extraction of scrap metal is achieved by an overhead magnetic separator. The almost odorless compost is sold at 25s per ton which helps to reduce the cost of refuse disposal.

"The Prat Composting System Proves Itself in Toulouse." Compiled by A. G. Davies. *Municipal Engineering,* June 30, 1961.

Drainage Problems and Solutions

The Metropolitan Sanitary District of Greater Chicago, which constructs and operates sewage treat-

Landfill in Lansing

THE CITY of Lansing, Michigan, employs a Harnischfeger shovel and a LeTourneau - Westinghouse Tournatractor on its sanitary landfill. The Tournatractor pushes the dumped refuse over the bank; later the shovel covers the waste with earth which is later leveled by the tractor. The 20-acre dump, located southeast of the city, will be utilized for some other purpose after it is completely filled. The city expects to apply the fees earned for dumping charges toward the purchase of a new landfill site when it becomes necessary.

On Guard

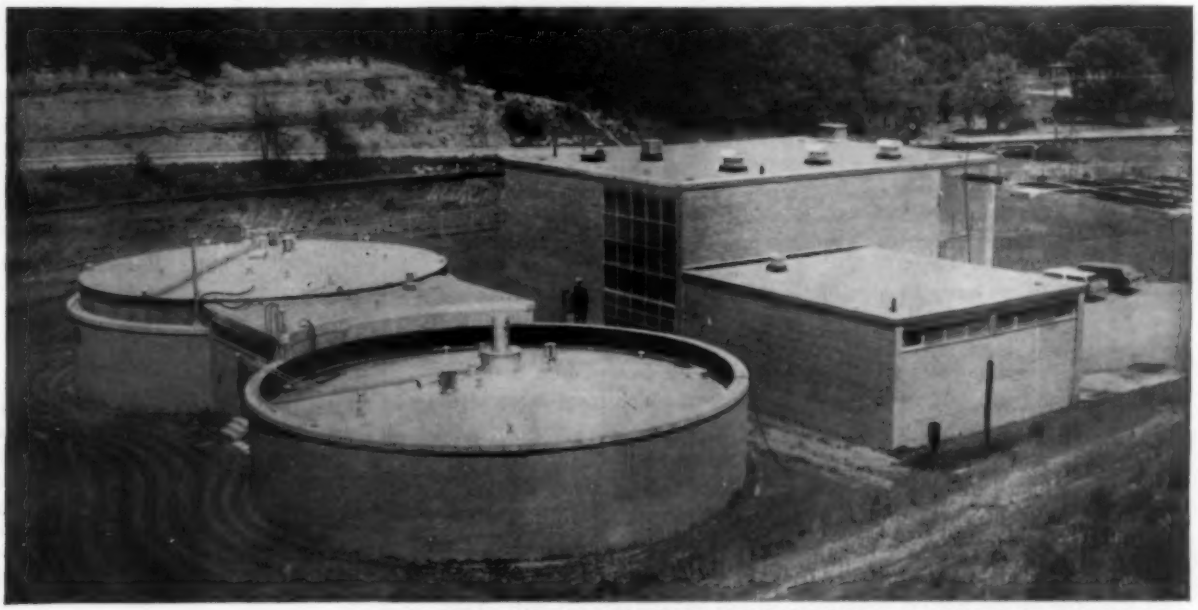
against pollution with P.F.T. equipment at Bethel, Pennsylvania

The Borough of Bethel, Pennsylvania has become the fifth largest borough in population in the entire state even though it is only 65% developed.

Rapidly expanding, 400 new homes being built each year and increasing numbers of new industries moving into this area, Bethel's civic leaders have recognized the need of an efficient sewage treatment plant.

Today, this modern sewage treatment plant is a major factor in attracting new industries and assuring the healthy growth and development of this area.

The following P.F.T. equipment is giving Bethel a plant providing an effective and important health-guard for this community. 1 P.F.T. 55′ Floating Cover, 1 P.F.T. 55′ Spiral Guided Gas Holder; both provided with a P.F.T. Gas Recirculation System, P.F.T. Insulated Aluminum Roofing, 2 P.F.T. Liquidometer Cover Position Indicators with High and Low Level Alarms, 1 P.F.T. #750 Heater and Heat Exchanger Unit and P.F.T. Gas Safety Equipment.



Bethel's Sewage Treatment Plant Designed by Chester Engineers, Consulting Engineers, Pittsburgh, Pa.

P.F.T.

waste treatment equipment exclusively since 1893

PACIFIC FLUSH TANK CO.

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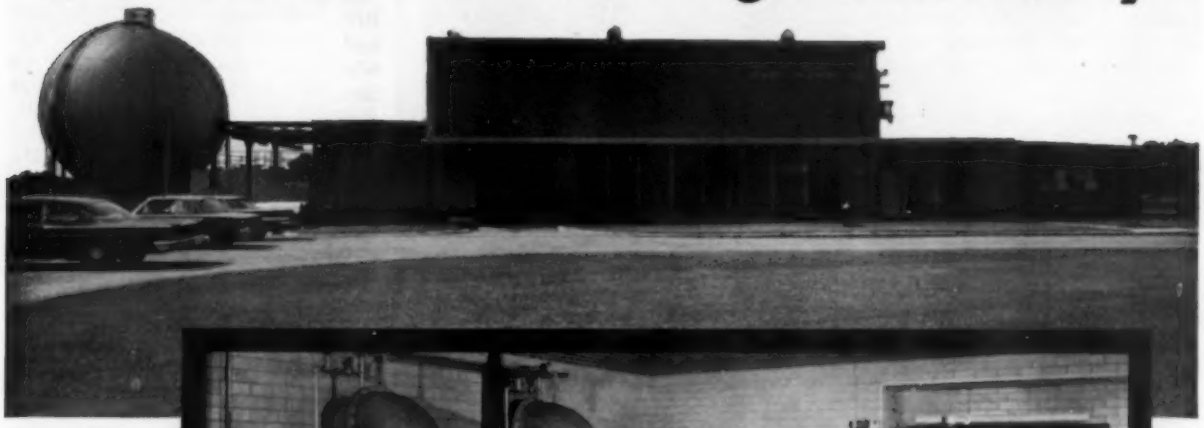
ment works for Chicago and its vicinity, has constructed low-level intercepting sewers at or near the banks of the Chicago and Calumet Rivers, the Sanitary and Ship Canal and their tributaries. At each point where the intercepting sewers pass under a combined sewer, a control structure diverts to the interceptor all dry-weather flows plus a predetermined percentage (usually 75 to 200 percent extra) during storm periods. Flows over and above these quantities discharge into the open watercourses. It is estimated that the annual volume of sewage spilled is only about 3 percent of the total of the household and industrial wastes. To eliminate all river pollution by the construction of a separate system of sanitary sewers would cost the City of Chicago approximately $2.5 billion—an average cost of $17,500 per acre over the City, and an impossible expenditure. If separate sanitary sewers were constructed, the storm water drainage system could be designed with local detention reservoirs that would detain the storm runoff from a local area until the drain has an opportunity to carry it away following the rainstorm. The detention basin should be designed large enough to hold the total runoff (less the safe quantity of outflows through the underground system) from at least the maximum storm of record. Several examples are given in this article and the various factors influencing design are discussed.

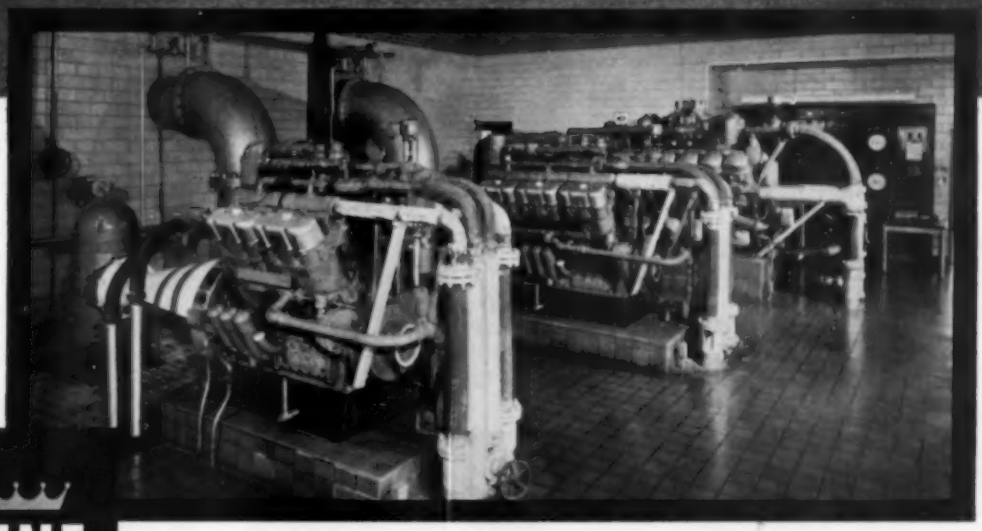
"Storm Drainage Problems and Solutions." By A. L. Tholin, Engineer of Public Works, City of Chicago, Ill. *Public Works*, August, 1961.

New Approach to Plant Expansion

The City of Vacaville, California, placed in operation in June, 1960, a new sewage treatment plant which will meet the basic needs of this expanding industrial community over the next several years. One of the requirements of the new plant was that it must operate in an odor-free manner due to its nearness to a neighboring residential community. Another factor was that the principal industry was an onion dehydrating plant which produced a highly odorous waste. Early in the preparation of the report, prior to design, it was realized that some form of activated sludge treatment must be used: 1) i.e., either standard activated sludge treatment, 2) step aeration or 3) total

PUMPING 15 million gallons daily





City of JOLIET, ILL. Sewage Treatment Plant with its three ROILINE Engines

ROILINE ENGINES do it *with sewage gas fuel*

Pumping fifteen to twelve million gallons! Joliet's city sewage treatment plant does it—every day.

The Worthington sewage pumps are driven through Amarillo right angle gears by ROILINE Engines *using sewage gas for fuel.*

ROILINE Model L-3000 runs *continuously*, 107 hp at 545 rpm, capacity 10,400 gpm; 12-cyl., 6¾-in. bore x 7-in. stroke, 3006 cu. in. displ.

ROILINE Model H-2000 as an *auxiliary*, 75 hp at 637 rpm, capacity 7,300 gpm; 8-cyl., 6¾-in. bore x 7-in. stroke, 2004 cu. in. displ.

ROILINE Model L-3460 as a *standby*, 151 hp at 530 rpm, capacity 15,300 gpm; 12-cyl., 7¼-in. bore x 7-in. stroke, 3468 cu. in. displ.

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MINNESOTA, Minneapolis, Central Equipment Co.
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NEW YORK, Syracuse, Schenectady and Lisbon J. C. Georg Corporation
OHIO, Columbus, Cantwell Machinery Company
OKLAHOMA, Oklahoma City and Tulsa Carson Machine & Supply Co.
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TEXAS, Houston, Dallas, San Antonio, Kilgore, Corpus Christi, Beaumont Southern Engine & Pump Co.
Lubbock, Farmers Supply
Odessa, General Machine & Supply, Inc.
Wichita Falls, Nortex Engine & Equipment Co.
WYOMING, Casper, Emrick & Hill Engine & Equipt. Co.

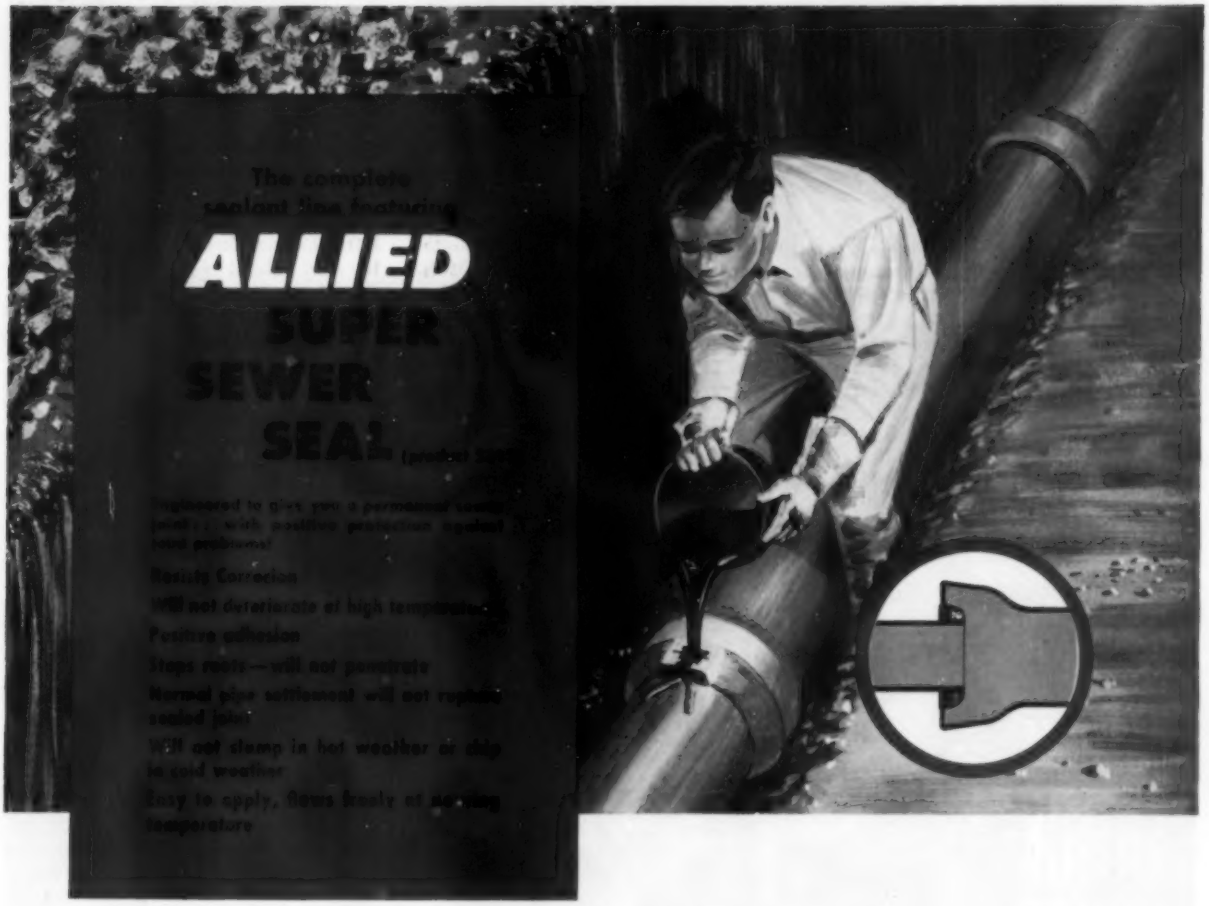
WAUKESHA MOTOR COMPANY, WAUKESHA, WIS. / **New York • Tulsa • Huntington Park, Calif.**
Factories: Waukesha, Wisconsin and Clinton, Iowa

oxidation. In fact all three forms of activated sludge treatment will be used in the 3-stage expansion program. During the first stage of the expansion program, the plant treatment consists of the total oxidation method of operation. Raw sewage enters the aeration tank mixed with the return sludge. The scum which would normally be removed in the primary sedimentation tank is removed from the final sedimentation tank and recirculated to the aeration tank. All of the distribution channels for the final stage of construction (step aeration) have been provided. The aeration tank represents the total volume that will be required in the ultimate stage. No additions to equipment nor tank volume will be required. During the first stage the existing plant is still in service and the combined capacity of the two plants is 2.5 mgd. The old plant will not be abandoned until growth in that area dictates the necessity of doing so. In the second stage the mode of operation is changed to that of a standard activated sludge plant. The capacity can be increased to either 2.5 mgd, by adding one primary sedimentation tank and one digester, or to 3.75 mgd, by adding two primary sedimentation tanks, one final sedimentation tank and one digester. In the third stage, the mode of operation is changed to that of a step aeration plant and the capacity is changed to 5 mgd. Since the new plant was placed in operation it has performed satisfactorily treating a flow varying from 0.8 mgd in the winter to 1.5 mgd in the summer without any odor complaints. The construction cost of the first stage was $543,000.

"A New Approach to Sewage Treatment Plant Expansion." By M. Carleton Yoder, Consulting Engineer, Berkeley, California. *Public Works*, August, 1961.

Economical County Landfills

San Bernardino County, the largest county in the U. S. covering 20,131 square miles, disposes of rubbish for its 503,591 residents for an annual operating budget of $358,011, excluding land cost—or at an annual per capita cost of 77 cents. Three Caterpillar D8H and two old D7 tractors are used in the maintenance of the four landfill sites located in the heavily-populated valley area and the 28 open burning dumping areas located in the desert and mountain regions of the county. Another D7 is currently preparing an extension to an existing landfill. Factors which have helped to keep operating costs down are cooperation between the county and cities in pick-up and disposal efforts, placing the disposal program under the County Highway Department, locating the landfill sites to assure sufficient volume per load, and using reliable heavy-duty tractors to handle large volumes efficiently. Experience has shown that one large tractor can serve 75,000 residents efficiently and economically. At the largest landfill area, known as Plunge Creek, the refuse is being utilized to construct a 1,400-ft. levee as protection against the Santa Ana River and Plunge Creek. Approximately 250 feet wide at the base, the levee reaches a total height of 35 feet, including 10 feet below grade. Plans are already under way for a 5 to 6-mile levee on the south bank of the Santa Ana River. One area of 31-acres is being reclaimed and will become an industrial site. One 60-acre area is expected to be used eventually as a recreational area. An abandoned rock quarry, approximately 150 feet



Allied's Quality Control Saves You Money, Time and Manpower.

Every pound of Allied Super Sewer Seal gives you maximum performance for trouble-free sealing. This hot poured sewer joint compound has been engineered to the most rigid specifications by Allied all the way from research and development to production. It has been performance-proved on the toughest jobs. You can use Allied Super Sewer Seal with confidence that it will perform *as specified* under the most rugged conditions.

The World's Finest Hot Poured and Cold Applied Sewer Joint Sealing Compounds.

The Allied line of sewer sealants covers the ENTIRE field. Choose the one suited to YOUR needs . . .

PRODUCT NO.	DESCRIPTION
*5312 Super Sewer Seal	Hot Poured Plastic Type
*5310 Sewer Seal	Hot Poured Asphalt Type
*5311 Sewer Seal	Hot Poured Asphalt Type
*9859 Sewer Seal	Hot Poured Coal Tar Type
*9865 Sewer Seal	Hot Poured Coal Tar Type
7206 Sewer Seal	Cold Applied Asphalt Mastic Type
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***These Products meet all requirements under Federal Specifications SS-S-169**

For further information about ALLIED SUPER SEWER SEAL and the complete ALLIED Sewer Seal line, write:

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Producers, Refiners and Compounders of Special Asphalt and Coal Tar Products

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PLANTS: Stroud, Okla. Detroit, Mich. Los Angeles, Calif.

deep, will eventually become a 20-acre park site in about 5 years.

"County Runs Economical Landfills." By. J. R. Hiller, Rubbish Disposal Superintendent, San Bernardino County, Calif. *Public Works*, August, 1961.

Waterloo's Wastes Treatment Plant

The City of Waterloo, Iowa, recently completed the first stage of construction necessary to meet the overall solution of its sewage treatment problem. Based on studies made several years ago it was estimated that it would cost approximately $3 million using "conventional loadings" to expand the plant capacity to provide treatment for the large quantity of packing house wastes with a population equivalent of 532,000 while the municipal wastes represent a population of only 75,000. A consulting engineering study was designed in two parts, Part I to compile data to allocate operating costs between the Rath Packing Company and the City. Part II was a study of the sewage treatment plant to develop a program to meet present and future needs. These studies developed the serious deficiencies in hydraulic capacity to handle the sewage and industrial waste flows. Serious bottlenecks to flow were found due to hydraulic limitations in the piping and appurtenances, necessitating the bypassing of about 1.1 mgd of the main line primary clarifier effluent to the river. This discharge amounted to about 3,500 pounds of BOD to the Cedar River compared to only about 6,000 pounds contained in approximately 14 mgd passing through the final clarifiers. Several other hydraulic bottlenecks were found in the filter distributors, filter and clarifier diversion boxes and final clarifier effluent channels. After these studies, the first logical step in the improvement program was, therefore, to increase hydraulic capacity to meet design requirements. As a result of this expansion program, the Rath Packing Company and the City of Waterloo were able to agree upon the terms of a contract whereby the City would continue to receive and treat the wastes from the meat packing industry.

"Sewage-Wastes Plant Operates At 'Unconventional' Loadings." By H. R. Veenstra and J. W. Kimm, Stanley Engineering Company, Consulting Engineers and M. L. Wickersheim, Superintendent, Sewage Treatment Plant, Waterloo, Iowa. *Wastes Engineering*, July, 1961.

Irrigating With Sewage Effluent

Sewage treatment plant effluents have been used for many years in semi-arid regions of the United States. San Antonio, Texas, is situated in a region which experiences cycles of drought and limited rainfall and since 1901 has used sewage for purposes of irrigating various crops and pasture land. At that time a ditch and a dam on Mitchell Lake were constructed for disposal of the sewage. In 1930, a modern sewage treatment plant was put into operation with a flow-through capacity of 25 mgd. This plant served the city until 1951 when another plant which doubled the plant capacity took its place. At the present time the plant has a capacity of 82 mgd. During normal plant operation, the canal to Mitchell Lake receives clear final treatment plant effluent, which amounts to about 85 or 90 percent of the flow discharged to the canal. About 6 to 10 percent of discharge volume is primary treated sewage, from which most of the suspended solids have

been removed. Digester supernatant liquor, containing 2,000 to 5,000 mg/L suspended solids and about 400 mg/L ammonia nitrogen, constitute about 2 to 5 percent of the flow to the lake. Excess activated sludge, consisting of from 6,000 to 8,000 mg/L suspended solids, and about 6 percent nitrogen make up the remaining 1 to 2 percent of the discharge to the canal. During normal plant operation, digester supernatant is pumped to the canal each day and imparts a black color to the water. The quantity of sewage in various stages of treatment diverted to the canal averaged about 15.9 mgd. in 1960. Any water discharged from the sewage treatment plant which does not empty into the San Antonio River, flows through the 3 mile long canal to Mitchell Lake. From the canal and from Mitchell Lake, water is taken to irrigate more than 4,000 acres of land. The irrigated land is primarily pasture land but other crops are also irrigated including maize, oats, corn, castor beans and cotton. The principal forage crops are Bermuda grass, Johnson grass and Luden grass. A question of a hazard to the health of employees, i.e., farmers and ranchers and their hired hands, must always be considered. Another question which is not answered completely satisfactorily from a health standpoint is the use of sewage plant effluent for the irrigation of vegetable crops. With certain precautions the hazard to health certainly can be minimized to a very low level.

"Irrigation As a Sewage Re-use Application." By W. N. Wells, Sewage Treatment Plant Supt., San Antonio, Texas. *Public Works*, August, 1961.

Other Articles

"Designing **Biological Oxidation** Systems for Industrial Wastes." Part 3. How to compute and design wastes treatment facility capacities, based on the biological oxidation principles covered in this series. By W. Wesley Eckenfelder, Jr., Assoc. Prof. of Civil Engineering, Manhattan College. Wastes Engineering, July, 1961.

"**A Review of the Literature** of 1960 on Wastewater and Water Pollution Control." This last of three sections of the Literature Review covers water pollution. The authors comprise the Research Committee of the Water Pollution Control Federation, H. Heukelekian, Chairman, Journal WPCF., July, 1961.

"Construction and Operation of **the Pittsburgh Project.**" This project serves 71 municipalities, including the City of Pittsburgh, with a total present population of 1,200,000 and costing $100 million. By John F. Laboon, who was Executive Director and Chief Engineer of the Allegheny County Authority until August 31, 1960, when he retired and was appointed as consultant to the Authority. Journal WPCF., July, 1961.

"L'Esthetique des Stations de **Traitement des Eau Usees.**" (Esthetics of sewage treatment works.) The engineer and architect can design treatment works in a satisfactory manner from an esthetic standpoint. par M. Ed. Utudjian, Architecte, D.P.L.G., Secretaire general du Groupe d'Etudes et de Coordination de 1' Urbanisme souterrain. Techniques et Sciences Municipales, Mai, 1961.

"Radcliffe Has a **Refuse Composting** Plant." A Dano type of composting plant began operating in May, 1961. By T. Kay, MBE, AMICE, MiMunE, Borough Engineer and Surveyor, Radcliffe BC. Municipal Engineering, July 7, 1961.

"Pesticides, Chemicals and Water Pollution." Most surface waters receive a large, variable and anonymous load of organic chemicals. By Clarence Cottam, Director, Welder Wildlife Foundation, Linton, Texas. Public Works, June, 1961.

MILWAUKEE JOURNAL PHOTOS

"For a smooth pick-me-up, you can't beat a HYDROCRANE"

The unusual operation described here may seem far removed from your job. Yet, is it really? Look.

Don't you handle costly loads? . . . like transformers, prestressed concrete sections, or porcelain insulators?

Samson and Sambo were labeled "priceless" by the director of the Milwaukee County Zoo. That's why the HYDROCRANE®, with its unmatched gentleness and quietness was chosen for this delicate moving job.

Isn't travel speed important in order to cut down unprofitable between-job travel?

In this case the HYDROCRANE moved fast enough to stay with the job. It was on hand to place the cage gently on the truck. And it was there in time to unload it at its destination.

Don't you often have a touchy positioning problem?

HYDROCRANE'S telescoping boom was able to ease the cage gently out under low overhead structures and to nose it into place at the new zoo.

6H61

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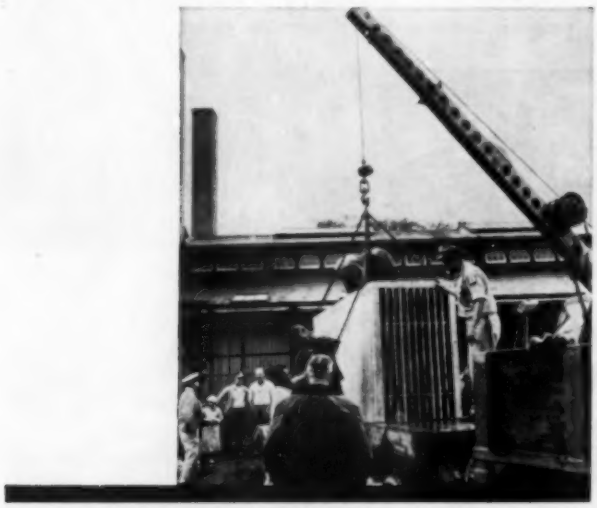
Let your Bucyrus-Erie distributor tell you more about the HYDROCRANE features that will make your job faster, easier, and safer.
Bucyrus-Erie Company, South Milwaukee, Wisconsin.



Goodbye to the old home—the HYDROCRANE crane-excavator eases Samson's and Sambo's portable cage out of the gorilla house at the old Milwaukee Zoo. Gentle handling and low sound level were two reasons for choosing this machine.

Welcome to the new home — there was no delay for Samson and Sambo at their destination. Fast travel speed enabled the HYDROCRANE to move quickly through city traffic . . . to be on hand for the delicate unloading operation when the gorilla cage arrived.

To Be Shown at APWA:

How to Inspect Sewers by TV

A MOBILE electronic control center, demonstrating American Pipe Cleaning Company's "Monitored TV Pipe Inspection" service —inspection of underground pipes by closed circuit television—will be shown at the 1961 APWA Convention in Minneapolis. This pipe inspection program permits location of trouble spots and problems in underground pipes without disrupting municipal services or requiring unnecessary tearing up of pavements.

Sealed in a water-tight capsule, the self-focusing APCO TV camera inspects the interior of sewer and water pipes six inches in diameter and larger. As the camera passes along the pipe interior powerful lights installed within the tube permit the camera to pick up and project a clear and precisely detailed picture to the television control room.

Convention guests will be able to step inside the air-conditioned control room of the mobile electronic control center at the exhibit to see exactly how a technician monitors the pipe inspection program on the highly specialized television receiver. This receiver has up to 800 lines of resolution as compared to 300 for the average home set.

Camera Finds Defects

In sewers, the TV camera detects such problems as separated joints; structural failures and settled pipes; obstructions caused by root penetration; sand; grease; and other accumulations. The TV pipe inspection will locate non-uniform grades in sanitary sewers that can seriously decrease velocities and result in settlement of solids.

In one typical APCO monitored TV sewer inspection covering a 20-block area in a Midwestern city, the TV camera discovered: Two definite pipe fractures; two sections of settled pipe, permitting excess water infiltration; several offset tiles; and numerous penetrations of thick roots through deteriorated joints.

In addition to focusing on separated joints, structural failures and settled pipes, the TV pipe inspection in sanitary sewers frequently locates other problem areas, such as bad service connections to homes,

● **CONTROLS of the television sewer inspection unit which will be open to visitors at the APWA convention. At top center is shown a view of typical sewer interior.**

...15 seconds with Fairbanks-Morse Diesels

The F-M 38D8⅛ Opposed-Piston Diesel Generating Unit—with only 15 seconds *from cold start* to full power—gives fast, sure power for peaking or for standby use, together with impressive operating economies.

This unit requires no spinning reserve . . . uses no power until it starts, then produces up to 2500 kw per unit. Can be linked in multiple units.

Dependable? Service records of F-M Diesels prove dependability beyond a doubt (F-M pioneered the manufacture of diesels in America . . . has kept in the forefront ever since.)

Economical? The 38D8⅛ has 40% fewer moving parts than comparable engines of equal horsepower. This means reduced maintenance costs . . . fuel and lube oil savings.

Opposed-piston design minimizes vibration, produces fine balance . . . smooth power and instant response that result in 15 second full-power operation. Available with 4, 5, 6, 8, 10 or 12 cylinders, ranging from 450 to 2500 kw per unit, with automatic or manual controls. **For full details or custom specifications, write today to: S. K. Howard; Director of Marketing; Fairbanks, Morse & Co.; Beloit Division; Beloit, Wisconsin.**

FAIRBANKS MORSE
A MAJOR INDUSTRIAL COMPONENT OF
FAIRBANKS WHITNEY

lost connections and lost manholes. The APCO service is equally effective in locating faults in storm sewers and in wells and conduits, ducts and other places not readily subject to inspection.

As an added feature of this pipe inspection service, movies or still pictures of trouble spots are taken off the monitor by a technician to provide a pictorial reference for later use by repair and cleaning crews. Exact locations of these problem areas in pipes are measured accurately to within 12 inches by APCO crews.

Demonstrations of monitored TV pipe inspection service, including movies and photos of actual pipe inspections taken from the monitor, will be shown to convention visitors by APCO throughout the APWA meeting.

Microstrainer for Water Supply

A new filtration plant, planned for Grand Junction, Colo., for which $150,000 has been allotted, will utilize a microstrainer in the treatment process.

Freeway Reflectors Aid Night Drivers

More than 35,000 white and amber reflectors mounted on steel posts are being placed along the shoulders of Michigan freeways to aid motorists driving at night, the State Highway Department reports.

Single white reflectors are being installed every 200 feet along 550 miles of freeway and double amber reflectors are being placed every 100 feet along on and off ramps at interchange points.

Most of the reflectors are being set in place by contractors as new sections of freeway are opened. In addition, Highway Department crews are installing reflectors on all other divided state highways.

The Highway Department said the reflectors help to define the roadway and ramps at night. Nearly 800 miles of freeway will be open to traffic in Michigan by the end of this year and they will be lined with more than 50,000 roadside reflectors.

Sewer Cleaning and Flushing

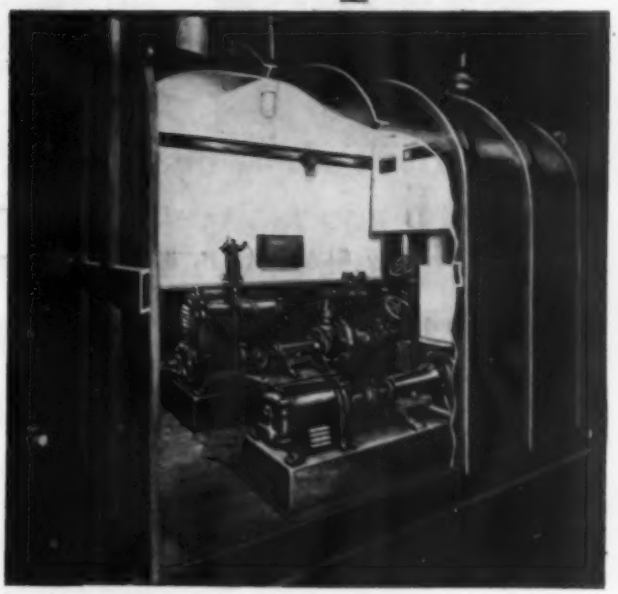
All sanitary sewers in Waukesha, Wisc., were flushed at least once during 1960 while some of the lines laid on flat grades and carrying small flows were flushed as often as twice a month.

FROM TEX-VIT

New Equipment Development

The Revolutionary Rectangular-Shaped Packaged Pump Station

TEX PACKAGED QUAD PUMP STATION

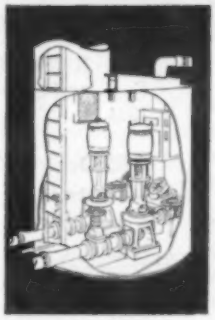


TEX-QUAD is designed to fit the equipment!
For years manufacturers have been forcing bulky sewage pumping equipment into round or oval stations when the equipment is designed for a rectangular station.

TEX-QUAD is designed for the operator!
The servicing of a pump or motor is frequently a two-man job. In "old style" stations, this function is hindered. With the TEX-QUAD operators are given every consideration!

TEX-QUAD "Level-Line" pumps increase serviceability!
Its rectangular design permits the use of horizontal pumps which eliminates the suction elbow found on vertical pumps. This improves the hydraulic flow in the suction inlet of the pump.

TEX-QUAD can provide more room for future additional pumps!
Its new shape allows for the addition of pumps and motors as needed. Depending on the size station, as many as five pumps can be used to handle a total capacity up to 10,000 GPM!

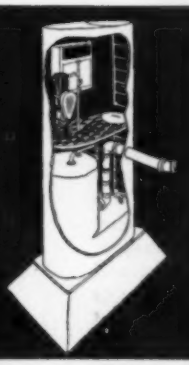


ROUND PUMP STATIONS, TOO!

TEX-VIT's Round Pump Station gives you extra rugged design, construction and dependability, too. Its four-bearing pump assembly with Flexible Coupling is housed in a heavy steel, water tight shell.

This station's exclusive features assure maximum dependability and simplify future modification.

Greater Reliability With Other TEX-VIT Equipment Designs

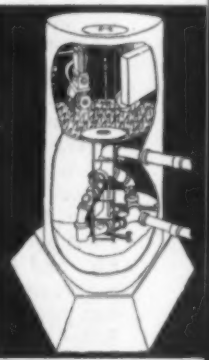


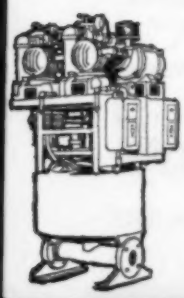
ELLIPTO-JECT or DELTA-JECT

Packaged Pneumatic Sewage Lift Stations

Both packaged stations perform the same function. But the ELLIPTO-JECT is a simplex pneumatic ejector station, and the DELTA-JECT is a duplex station. Their heavy steel shell-within-a-shell design provides maximum protection for the air storage tank, sewage receiver, controls and other components.

Available in 20 to 200 GPM capacities, both stations will handle large solids and operate odor-free (because they are hermetically sealed). They feature a wide degree of flexibility and are easy and economical to maintain. Each performs without troublesome bar screens, grinders or moving parts in the sewage.





EJECT-ALL

Pneumatic Sewage Ejector

This simple, highly-effective mechanism lifts sewage by means of compressed air. It eliminates many disadvantages inherent in centrifugal pumps.
Because there are no moving parts in contact with sewage, maintenance is held to a minimum. Without the use of bar screens, the EJECT-ALL will handle any solid that can pass through the house service line. It is available in 20 to 600 GPM capacities.

Write today for catalogs on any products by . . .

TEX-VIT
MANUFACTURING COMPANY
Formerly TEX-VIT Supply Company
P. O. BOX 117-pw MINERAL WELLS, TEXAS

THE INDUSTRIAL WASTE DIGEST

Prepared by **CLAYTON H. BILLINGS,** *Associate Editor*

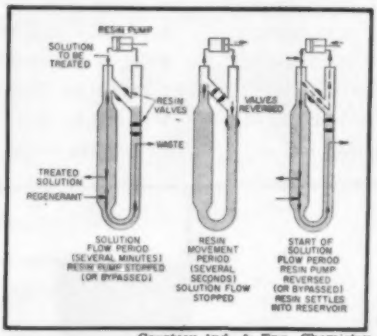
Waste Treatment by Higgins Contactor

The Higgins continuous countercurrent solid-liquid contactor, under development since 1951, has been tested at the Oak Ridge National Laboratory for a number of applications including removal of cesium—137 from alkaline radioactive waste. The contactor is a loop of pipe or other material appropriate for the liquid being treated, in which an ion exchange resin is suspended as a dense slurry. The purpose of suspending the resin is to permit the resin particles to flow from one side of the loop to the other, so that simultaneous treatment and resin regeneration can occur. The solution (or waste) is fed into the top of one side of the loop and the treated waste is removed at the bottom of the same side. Regenerant is introduced into the other side of the loop at the same time. During this period the resin is locked in place by valves. Following the treatment period, valve positions are reversed, and the liquid in which the resin is suspended is recirculated by a pump. The surges produced cause the resin particles to move around the loop and exchange places. Thus a regenerated bed of particles is in the proper position to receive the waste to be treated in the next cycle. The solution flow or treatment cycle is usually several minutes and the resin movement stage a few seconds. In testing the contactor on waste treatment at Oak Ridge, nitric acid wastes are neutralized with sodium hydroxide causing fission products to precipitate. The supernatant, however, retains most of the cesium - 137 and a small concentration of strontium - 90. Duolite C-3 resin was employed in a Higgins contactor to remove the cesium. The waste activity was reduced from 10^5 c.p.m. per ml. to background level in a 3-foot loading section of a 1½-in. diameter contactor. The feed rate was 10 to 30 gpm per sq. ft. The contactor has also been applied to soften Oak Ridge water, with an application rate of 10 gpm per sq. ft. This allows a 10-fold reduction in equipment size over conventional "fixed-bed" exchangers.

"Continuous Ion Exchange Equipment Adapted to Water and Dilute Waste Treatment." By Irwin R. Higgins, Chemical Separations Corp., Oak Ridge, Tenn. *Industrial and Engineering Chemistry,* August, 1961.

ABS Destruction In Britain

Since 1956, efforts have been made in England to encourage the manufacture and use of a synthetic detergent containing a "soft" or biological reducible form of alkyl benzene sulphonate. By 1958, such a compound was believed to have been produced, identified as sodium Dobane JN sulphonate. The Water Pollution Research Laboratory was asked to make extensive investigation into the effect of the new material on sewage treatment. Laboratory tests indicated that 94 percent "soft" ABS could be removed from an initial concentration of 13 ppm (as Manaxol OT), by trickling filters or activated sludge treatment. Larger scale tests were then commenced using the Town of Luton as the experimental site, with a large proportion of the detergent used replaced with the new material. While a significant reduction has been achieved in the concentration of ABS in the effluent, the established goal has not been reached—75 percent reduction of the amount of detergent discharged to the effluent wasteway. This is attributed to incomplete reduction of "hard" detergent stocks, the presence of hard ABS in scouring powders and similar materials and to the less efficiency of the full scale sewage treatment compared with that in the laboratory.



Courtesy Ind. & Eng. Chemistry

● **DIAGRAM shows flow in continuous countercurrent solid-liquid contactor.**

"The Destruction of Akyl Benzene Sulphonates in Sewage Treatment Processes." By G. E. Eden and G. A. Truesdale. Water Pollution Research Laboratory, Stevenage, England. *Water and Sewage Works,* July, 1961.

Detergents and Aeration Tank Frothing

Various conflicting theories have been expressed as to the role of detergents in causing the frothing of aeration tanks. One report contends that frothing is caused by degradation compounds produced during oxidation. To test this theory, the effect of starches, proteins and fats and their degradation products on the frothing characteristics of alkyl benzene sulfonate was studied. Conditions in an aeration tank were simulated, using laboratory apparatus and compressed air. Degree of frothing was judged by the height of the foam produced. Neither starch, maltose, nor glucose produced froth on aeration but they do tend to inhibit frothing in ABS (Nacconol) solutions. Proteins did

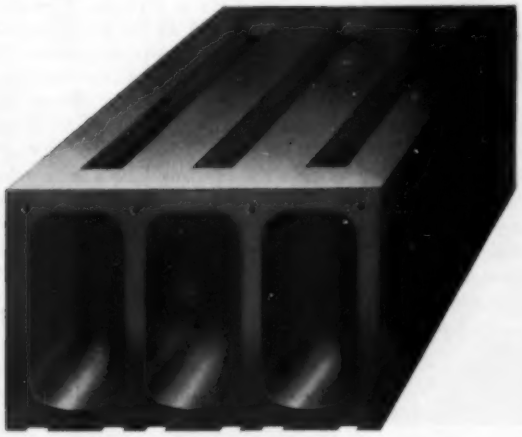
NATCO TRI-FILTER BLOCK

for improved performance in trickling filters

Tri-Filter #5

Standard-Rate

Size	4¾" x 11¾" x 15½"
Weight per unit	28 lb.
Weight per sq. yd.	196 lb.
Aeration per sq. ft.	39.3 sq. inch
Aeration %	27.3%
Runoff sq. inch/lin. ft.	30.9 sq. inch
Runoff %	55.4%



Tri-Filter #8

Hi-Rate

Size	7½" x 11¾" x 15½"
Weight per unit	41 lb.
Weight per sq. yd.	288 lb.
Aeration per sq. ft.	39.3 sq. inch
Aeration %	27.3%
Runoff sq. inch/lin. ft.	52.4 sq. inch
Runoff %	59.3%

Conforms in all respects with ASTM Specifications C159—for Vitrified Clay Filter Blocks for Trickling Filters

DESIGNED FOR:

Maximum efficiency

- Aeration area increased
- Greater runoff capacity

Faster, easier installation

- Reduced laying time with only 7 units required to the square yard
- Increased bearing area for channel and perimeter cover blocks
- Simplified layout with 12" center-to-center spacing

High compressive strength—Low absorption rate

- Tested to loads up to several times that required by ASTM C159
- Less than 6% water absorption by standard 1-hour boil method

Complete assortment of supplementary shapes

- Fractional, filler blocks, reducers, extensions, miters and cover blocks
- Layout and takeoff service
- Quick delivery

The new Natco vitrified structural clay TRI-FILTER block combines maximum capacity, both in drainage and aeration, with high strength, ruggedness, permanence and corrosion resistance, and all at minimum cost.

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produce froth on aeration, and low concentrations of casein were effective in preventing frothing. Degradation products such as casamino acids had no effect on the frothing of Nacconol but low concentrations of proteose peptone reduced foam height. Emulsions of peanut oil in water in concentrations of about 100 mg/1 were effective in preventing foam formation. No evidence was found to show that the common food types, carbohydrates or fats, produced foam when aerated. The removal of detergent from solution by transfer to the foam produced was also studied. It was found to be dependent on the concentration of detergent, aeration rate and aeration period.

"Frothing of Detergents in the Presence of Carbohydrates, Proteins and Fats." By Gail P. Edwards, U. Kesavulu, Sheldon Smith and K. B. Lulla. *Journal WPCF*, July, 1961.

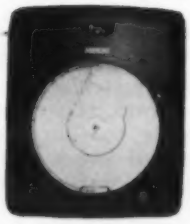
Incinerating Cyanides

At the Oldsmobile Division of General Motors, free cyanide and potassium ferrocyanide wastes were formerly treated and/or diluted to acceptable toxic levels and discharged to a stream. The procedures proved to be problematic and expensive. It was consequently decided to attempt to destroy the wastes by burning them in the presence of oil using an incineration method developed by Prenco Manufacturing Co. The wastes are trucked to a vault from which they are screw-conveyor fed to a premix tank for crushing to acceptable granule size and for reduction to a water slurry. In another tank the slurry is blended with soluble oil, preliminary to being discharged to the incinerator which is basically a refractory-lined steel tank. An annunciator-type control panel allows visual monitoring and control of burner functions. In starting up from a cold burner, a gas pilot flame is first lighted; gas or low-flash auxiliary fuel is then admitted to pre-heat the burner. Temperature is gradually increased at a rate of 150°F to 200°F per hour until the burner registers in excess of 2,200° F, the required temperature at which incineration can begin. The auxiliary fuel volume is gradually reduced as the temperature rises to 2,500°F. The temperature controller, which is part of the control panel, is pre-set to hold 2,500°F within a few degrees. At full volume setting,

Foxboro pH Dynalog Recorder has an input impedance of 80,000 megohms — eliminates the need for intermediate amplification. Span is adjustable from 2-10 pH; zero, from 0-12 pH.

pH Recording and Control without need for amplification

less drift, less cost, less maintenance, too!



Foxboro pH Dynalog Controller — for use where it is desired to hold pH at a predetermined value.

Foxboro pH Dynalog Indicator — for use where complete record of pH value is not required.

THAT'S RIGHT — the intermediate amplifier is gone from Foxboro's new low-cost system for measuring pH. And gone with it is the wasted panel space, the drift, the daily standardization inherent with earlier systems.

In the new Foxboro system, the signal from the pH electrode goes direct to a high impedance Dynalog* receiver — without intermediate amplification. Signal operates a direct-reading indicator or recorder—or a controller and alarms, when desired.

The new Foxboro pH system is the simplest, most economical method of measuring pH available today. Ask your Foxboro Field Engineer to tell you about it. Or write for data sheet. The Foxboro Company, 269 Norfolk Street, Foxboro, Massachusetts.

*Reg. U.S. Pat. Off.

FOXBORO Analytical Instrumentation

REG. U. S. PAT. OFF.

the cyanide-soluble oil blend is burned off at a rate of 150 gph.

"Incinerating Cyanide Slurries." *Wastes Engineering*, July, 1961.

Computations in Waste Treatment Design

This third in a series of articles on computations involved in designing biological treatment units for industrial wastes is concerned with sizing of settling tanks and sludge thickeners for activated sludge treatment units, handling and disposal of sludge, effects of temperature and effects of pH. A typical design problem is given which summarizes the procedures described in all three parts of the article. The unit area of a settling tank in sq. ft. per lb. of solids per day can be computed from results of laboratory settling tests. The mathematical relationship involves the desired concentration of solids in the underflow and in the interfacial layer at the settling velocity. In secondary settling tanks the concentration of solids in the underflow depends on the compaction characteristics of the sludge, which should be determined by tests to establish the ultimate concentration of solids. The effect of temperature on oxygen uptake has been found to follow a relationship involving the logarithm of the ratio BOD removal and sludge growth rate constants. Since all biological oxidation systems are enzymatic, they are readily influenced by pH. In many systems the pH will tend to approach 80 during treatment. The pH of significance is that of the mixed liquor rather than raw wastes, in activated sludge treatment.

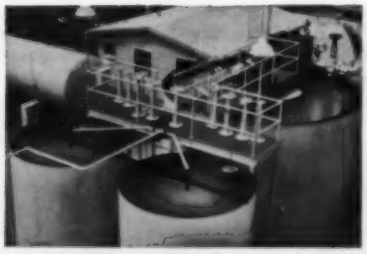
"Designing Biological Oxidation Systems for Industrial Wastes. Part 2." By W. Wesley Eckenfelder, Jr., Manhattan College. *Wastes Engineering*, July, 1961.

• • •

Cleaning a Digester

After being in use for about 20 years, the No. 1 digester at the Cranston, R. I., plant was completely cleaned. The heating coils in the interior were removed and a new heat exchanger system installed. A heavy deposit of about 90 cu. yds. of silt and other inorganic material had accumulated in the digester. This was loosened with a fire hose and discharged to a lagoon. A 700-gpm Wemco pump was found to be a great asset in handling the digester contents. Walter C. Anderson is Superintendent and E. G. Avery is Commissioner of Public Works.

Choose the water treating equipment you need from the complete INFILCO line

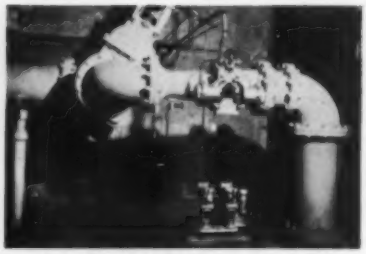


ACCELAPAK® treating plant, complete in a single package for the treatment of surface or well waters in capacities from 15 to 350 g.p.m. Ideal for small communities, industrial plants or institutions.

Bulletin 1870-A.

ACCELATOR® high-rate treating plant which combines in a single basin the separate processes of mixing, coagulation, clarification, and sludge removal saves up to 80% in space and produces the highest quality effluent. Designed for clarification, softening, or for combined treatment.

Bulletin 1825-D.



C.-A.-P. SYSTEM® pneumatic control for operation of water treating plants. Controlled air pressure directly actuates meters, feeders, and controllers and actuates operation of control valves.

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Gravity Filters... for wood, steel or concrete basins. Furnished with complete accessories, including meters, rate controllers, control panels or operating consoles. Designed to meet individual requirements. Sizes from 3′ diameter upwards.

Request information.

Type P Recarbonators... A pressure type recarbonator which eliminates the need for cooling apparatus and exposed gas lines. It operates in less than one-third space of old style systems and completely utilizes combustion gases to improve fuel economy.

Bulletin 1310.

VORTI® Mixers and VORTI-FLOC® Coagulators provide the advantages of low power consumption, no underwater bearings and effective mixing and floc formation. May be used in rectangular, square or round basins.

Bulletin 730.

These are only a few of the products for water treatment in the complete INFILCO line which includes equipment to meet your every need.

Write for our condensed catalogs and bulletins.

Filter Consoles... Provide maximum flexibility in plant control. Incorporate controls for hydraulic, pneumatic or electric actuation of filter valves, gauges for indication of loss of head, rate of flow, wash pressure and wash rate, and a rate setter for filter effluent.

Bulletin 1220.

INFILCO

INFILCO INC. • General Offices • Tucson, Arizona

Field offices throughout the United States and in other countries

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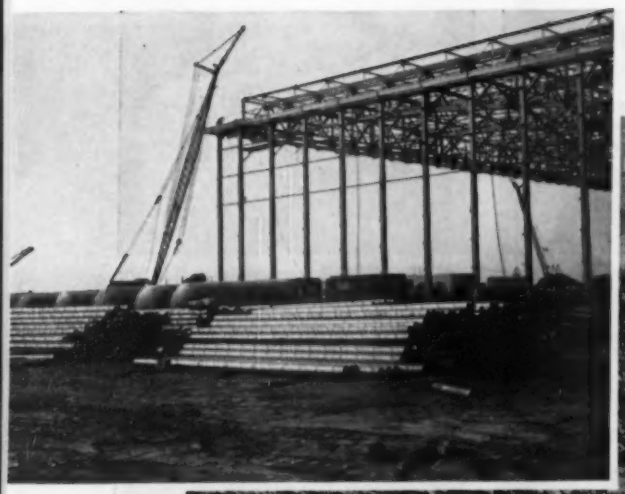
523

56,315 FEET OF REPUBLIC



Literally miles of Republic Drainage Products have gone underground at Chicago's $135,000,000 O'Hare Field expansion. Now covered by reinforced concrete many inches thick, Republic LOK-COR shown here is relied on to keep pavement and subsoil dry for the life of the runway.

DRAINAGE PRODUCTS

installed at O'Hare Field

Nearly eleven miles of Republic Drainage Products are being installed at O'Hare Field, Chicago, to help drain an area totaling 7,000 acres . . . very likely the largest project of its kind ever undertaken.

Republic *FREE-FLOW* and Republic Asphalt Coated and Paved Pipe up to 96" diameter have been installed beneath two new 11,000 foot jet runways, to handle water run-off. The pipe must stay in service . . . for the life of runways. Republic *FREE-FLOW* and Republic Asphalt Coated and Paved Pipe will. Like all Republic Drainage Products, these are made of heavy gage galvanized steel, corrugated for strength—and can be counted on to withstand constant impact, weight, and vibration of jet transport landings and take-offs.

FREE-FLOW has been installed in large, storm capacity sizes for drainage of graded areas along runways. Under hangars and hangar aprons more Republic *FREE-FLOW* and Asphalt Coated and Paved Pipe is used. In addition, many hundreds of feet of Republic LOK-COR Subdrainage Pipe, Galvanized Corrugated Pipe, and Pipe-Arch have been placed under approaches to hangars to carry away surface and subsurface water.

Contractors installing Republic Drainage Products used at O'Hare found advantages in fast, easy installation. Simplified design assures rapid, correct assembly . . . prompt deliveries direct from Republic's Hammond, Indiana Culvert Plant, keep the job on schedule.

This is a big job . . . but Republic Drainage Products are designed and priced for the small ones, too. Whatever your next project, look up your Republic Distributor for pipe that goes down fast and stays down. For complete literature, address Republic Steel Corporation, Dept. PK-2244, 1441 Republic Building, Cleveland 1, Ohio.

REPUBLIC STEEL

REPUBLIC HAS THE FEEL FOR MODERN STEEL

Thousands of feet of Republic *FREE-FLOW* Sewer Pipe were installed at O'Hare with minimum labor and equipment costs. Largest diameter 96" *FREE-FLOW* seen here is installed in the same manner as smaller diameters. Note lifting lugs for handling ease.

Ease of handling lengths of LOK-COR is demonstrated here. Pipe went in as fast as trenchers made the excavation—an important advantage in meeting an early 1962 completion date.

Here, a specially fabricated inspection hole is being installed in lengths of Republic LOK-COR, the drainage pipe that is helically corrugated for strength. The two-piece connecting band seen at right provides fast, positive joints.

Republic Drainage Products used in O'Hare Construction Project

RUNWAY DRAINAGE

Contractor: Consolidated Construction Co.—Chicago

Material: 1,100 feet of Republic *FREE-FLOW* and Asphalt Coated and Paved Pipe, 24" through 96".

600 feet of Republic Pipe-Arch.

TWA HANGAR

Contractor: Mayfair Construction Co.—Chicago

Material: 6,200 feet of Republic *FREE-FLOW* and Asphalt Coated and Paved Pipe, 12" through 42".

1,220 feet of Republic Pipe-Arch.

10,000 feet of Republic LOK-COR Subdrainage Pipe, 6".

AMERICAN AIRLINES HANGAR

Contractor: Malan Construction Corp.—Chicago

Material: 6,900 feet of Republic *FREE-FLOW* and Asphalt Coated and Paved Pipe, 12" through 42".

675 feet of Republic Pipe-Arch.

8,000 feet of Republic LOK-COR Subdrainage Pipe, 6" perforated.

UNITED AIRLINES HANGAR

Contractor: W. E. Schweitzer & Co.—Evanston

Material: 4,000 feet of Republic *FREE-FLOW* and Galvanized Corrugated Pipe.

300 feet of Republic Pipe-Arch.

13,000 feet of Republic LOK-COR Subdrainage Pipe, 6", 8", 10".

NATIONAL GUARD HANGAR

Contractor: Mayfair Construction Co.—Chicago.

Material: 1,600 feet of Republic *FREE-FLOW* and Corrugated Metal Pipe, 8" through 36".

1,200 feet of Republic LOK-COR Subdrainage Pipe, 6".

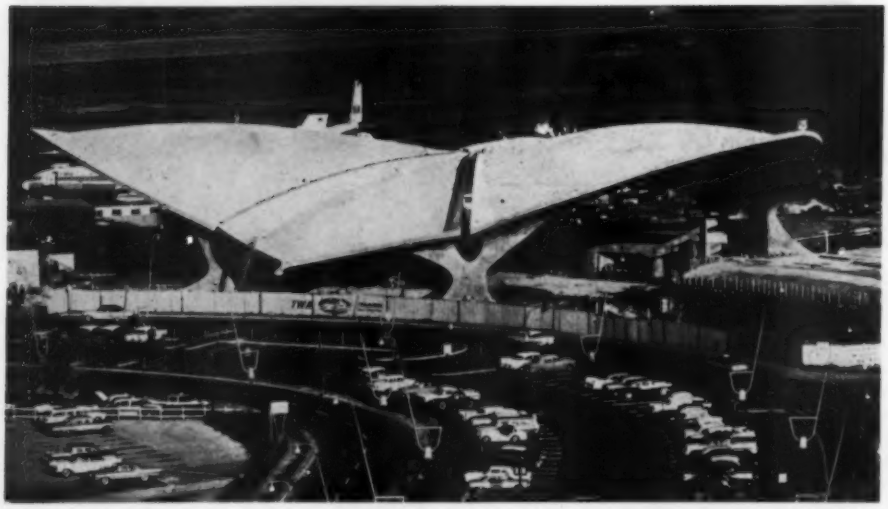
RUNWAY GRADING AND DRAINAGE

Contractor: S. J. Groves—Minneapolis

Material: 1,520 feet of Republic *FREE-FLOW* Pipe, 60" through 96".

Naess & Murphy: Architect—Engineer for City of Chicago.

Steel Strong, Modern, Dependable



● ULTRA-MODERN building has acre-size thin shelled roof which created fantastic problems in forming and shoring, with continuous pours.

Architect's Dream Makes Contractor's Nightmare

TO BE COMPLETED this fall, the TWA passenger terminal at Idlewild International Airport will stand as a monument to a building material—concrete—and to the architectural, engineering and construction genius that created it. Above the ground level, the structure is composed of only one piece of concrete; yet the execution of this deceptively simple design required ingenuity and planning, before the first cubic yard of concrete was ever mixed.

Of arch cantilever design, the 5000-ton roof of the building is of four monolithic concrete shells, flowing out of four sculptured buttresses. Joined integrally at a center plate, the shells vary in thickness from eight inches at their perimeter to 44 inches at the centerplate. The building is one of the few major contemporary U. S. structures in which all actual structural elements represent the final exterior architectural form.

The structure was conceived in three dimensions by Saarinen and Associates and reduced to plan by Ammann and Whitney, structural engineers. Grove, Shepherd, Wilson and Kruge, Inc. are the contractors.

The sweeping 1¼-acre concrete roof presented the most staggering challenge to engineers and builders. Facing the contractor's staff was the task of economically forming 3200 cubic yards of concrete into four perfectly balanced, monolithic roof sections, free of cracks, shrinkage stresses and construction joints, 60 feet above the ground.

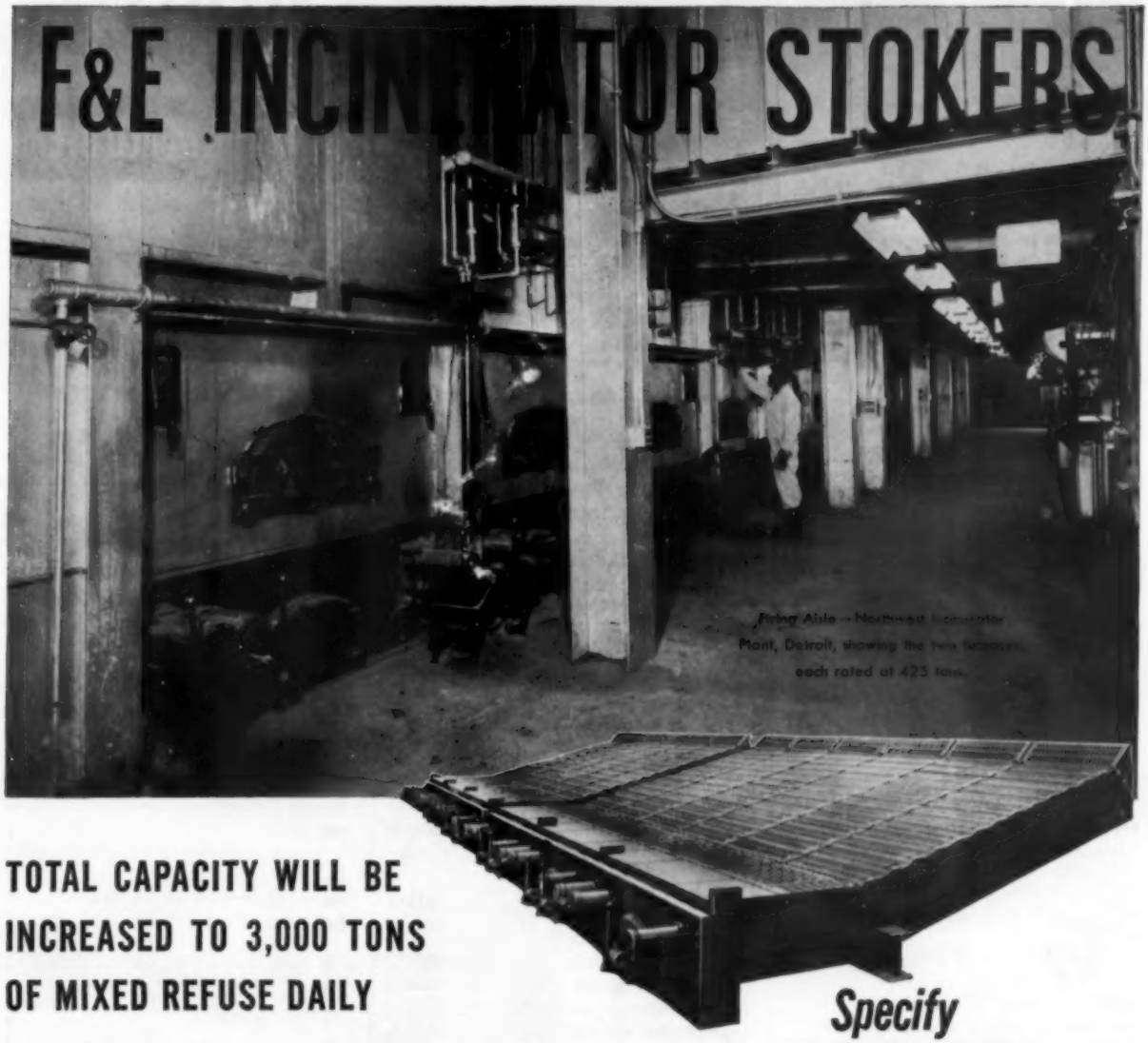
The final scheme for placing the roof called for initial construction of a center plate that would act as a bulkhead against which to pour the four shells and also provide a control station for subsequent concrete operations.

When pouring began, inspection crews of engineers and carpenters were stationed at key positions under the roof at ground level. Through a system of hanging plumbs, they were able to detect the slightest movement in the form work and radio this information to the central control station so the next bucket load of concrete could be directed for placement at a point that would compensate for the form movement.

In designing the concrete mixes for the shell and buttresses, special consideration had to be given to four major factors: 1) It must have

● PRECISE control of concrete set was key to timing the removal of the forms to permit finishing to the architectural contours required by the specifications.

DETROIT to install TWO MORE F&E INCINERATOR STOKERS



Firing Aisle — Northwest Incinerator Plant, Detroit, showing the two furnaces each rated at 425 tons.

TOTAL CAPACITY WILL BE INCREASED TO 3,000 TONS OF MIXED REFUSE DAILY

Seven F&E Multi-Cell Incinerator Stokers, with a total rated capacity of 2,325 tons of mixed refuse daily, are already in use in the various plants in the City of Detroit. Operating experience shows that all units easily exceed their nominal rating in normal operation, resulting in substantial savings to that city.

When additional incinerator capacity was required, F&E Multi-Cell Incinerator Stokers were again selected.

According to Mr. Theodore E. Winkler, Engineer of Waste Disposal, the City of Detroit will have a total rated capacity of 3,000 tons when the two F&E Incinerator Stokers now on order are installed.

Specify F&E Multi-Cell Incinerator Stokers

Complete Flexibility of Operation
Utmost in Economy—Reduced Labor
Rugged Construction—Lifetime Dependability
Progressive Burning for Maximum Results

CONTACT F&E TODAY
for engineering details and data.

FLYNN & EMRICH
BALTIMORE 2, MARYLAND

lowest possible unit water content and low cement content to minimize shrinkage; 2) there had to be careful control of slump, which had to be varied for different areas of the shell; 3) the setting time had to be retarded sufficiently to assure a completely monolithic structure for each shell; and 4) the setting time had to be varied according to a precise predetermined schedule to permit an orderly removal of counterforms or top forms, to allow finishing the surface of the shell to the final architectural contours.

Other Problems

Other mix design problems involved the selecting of a coarse aggregate for the normal weight concrete of the buttresses and a light weight aggregate for the shells—both aggregates of the same color to produce an overall uniform appearance for those areas that would ultimately be bush-hammered to achieve the surface texture desired by the architect. A low rate of heat evolution was desired in the buttresses and in the thick sections of the shells to prevent thermal stresses and cracking. Four-thousand psi strength at 28 days was specified for both the conventional and lightweight concrete.

The contractor, engineer and architect worked with Haller Testing Laboratory, Inc. and the Master Builders Co. in the design of mixes to meet these manifold objectives. In addition to its function as a water-reducing, plasticizing agent, Pozzolith was also used to control setting of the concrete mixes—to obtain different amounts of retardation from concrete placed in different areas of the shell. The range of retardation was one to four hours beyond the normal setting time of the mix. Automatic dispensing equipment at the two admixture dispatching stations facilitated the accurate addition of the material in amounts ranging from 0.25 to 0.40 pound per sack of cement.

The contractor's field project manager, Kenneth P. Morris calls this job "the biggest challenge to concrete and concrete men I've seen in my 30 years of construction. Every detail proceeded exactly as planned. The teamwork between our men, the resident architect, the engineers and the ready-mix and admixture people was the finest I've ever seen . . . and the 5,000 tons of sculptured concrete you see standing there is the best proof I know."

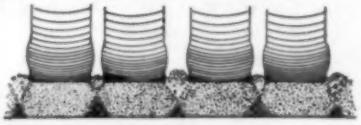
How Contractor Cut Base Compaction Costs On Interstate Paving Job

Seaman Duo-Pactor compacting gravel base to eight-inch thickness. Note that correct spacing of tires practically eliminates material displacement.

Four contractors on adjoining sections of an Interstate Highway paving job were required to compact granular base to eight inch thickness, 95% of modified Proctor. One* decided to try *Duo-Paction* on this type of lift, as previously he had used his three Seaman Duo-Pactors for compaction of fills, embankments, and for haul road maintenance.

Tests soon convinced both contractor and the engineer that *Duo-Paction* produced greater density throughout full depth of lift, at great time saving. Once again the Duo-Pactor had proved its ability to handle every phase of compaction, from fill to finish, at considerable cost reduction to the contractor.

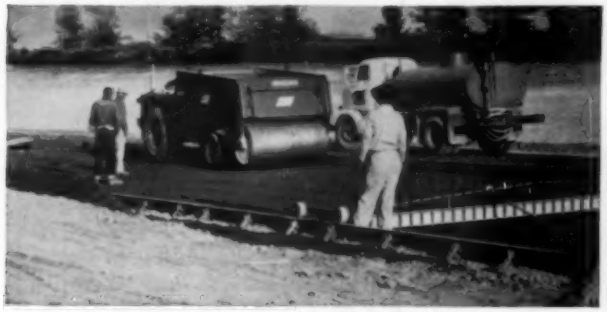
Faster, lower-cost compaction results from Duo-Pactor design employing the principle of *Duo-Paction*—combined pneumatic and steel rolling in one machine.



Correctly-spaced tires minimize material displacement, thus reducing the number of passes needed to obtain specified densities.

Correct spacing of the Duo-Pactor tires confines materials and minimizes displacement, thus developing higher, more uniform densities in fewer passes than with widely spaced tires. This is one reason why the Seaman Duo-Pactor has conclusively proved its ability to obtain uniform, high density compaction not only on fills and embankments, but also on subbase or base materials and stabilized surfaces, at *immense savings in man and machine hours*. Uniform density is further assured by lowering the steel roll, forcing ridged material down between the compacted tire tracks, while smoothing and leveling the surface.

From coast to coast, Seaman Duo-Pactors have job-proved their ability to meet the most rigid density specifications while saving up to 75% in man-hours and up to 50% in equipment cost, on all types of compaction, from fill to finish.



Working between the forms, this Seaman Duo-Pactor compacted four-inch gravel base just ahead of the paving crew.

Duo-Pactors are available in sizes with ballast variable from 7 to 20 tons, 9 to 27 tons, and 10 to 30 tons. In addition, compressive pressures can be varied by on-the-go, hydraulic adjustment of the wheel base. The 10-30 RD model is equipped with dump body for quick ballast adjustment or for use as a highway or off-highway materials hauler.

There's a Seaman Duo-Pactor that matches your exact job requirements. Write today for specification sheets!

*A certified contractor report from Seaman Corporation files.

Please send me Specification Sheets as checked below:

- ☐ 7-20-ton Duo-Pactor
- ☐ 9-27-ton Duo-Pactor
- ☐ 10-30-ton Self-dumping Duo-Pactor
- ☐ 8-20-ton Tri-Pactor
- ☐ 10-27-ton Tri-Pactor
- ☐ Pull-type Vibratory Impactor
- ☐ Self-Propelled Vibratory Impactor
- ☐ Utility 6-yd. Scraper
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Electrification of a Sewage Pumping Station

(Continued from page 131)

force mains immediately outside of the station and which have given excellent service (2) since they were put in operation in 1912, will continue to be used. However, two new register - indicator - recorders have been installed to be used in conjunction with the meters. Each register - indicator - recorder is equipped with telemeter equipment to transmit the two summarized sewage flows to the totalizer-indicator-receiver on the main control panel, which has been previously referred to.

An alarm system, actuated when a normally closed circuit is opened, has been provided to sound an alarm and indicate to the operator any abnormal condition as follows: 1) Low or high sewage level in suction well. 2) Low sealing-water pressure to glands of sewage pumps. 3) Low vacuum in the suction pipe of each sewage pump. 4) High water level in sump pit. 5) Low voltage of control storage battery. 6) High temperature of main transformers. 7) Main circuit breakers open. 8) Low pressure in city water supply pipes.

Simultaneous with the sounding of the alarm a red light is lit on the control panel, indicating what caused the alarm to ring. By pushing a button the red light can be extinguished and a green light is lit to indicate that the alarm system has been restored to normal operating conditions.

Four explosion-proof float-controlled units have been installed in the suction well of the pumping station. These units have been wired up with the alarm system to sound an alarm at a predetermined low elevation of the sewage in the suction well and also to shut down any sewage pump that is operating. Each unit is actuated by a 6½-in. diameter ceramic float and contains the necessary number of mercury switches. All of the metal parts of the float units are made of cast aluminum or stainless steel to resist corrosion.

A motor-driven centrifugal pump with a capacity of 9.5 gpm when operating against a total dynamic head of 170 ft. furnishes water continuously to the packing glands of each of the sewage pumps and to the small pressure piping between the two existing Venturi-meter tubes and their associated indicator-recorder-registers. This pump takes

CASE HISTORY

Total Deming Turbines 3

Total Service Years 32

Total Service Calls 1

MAINTENANCE RECORD—DEMING PUMPS			
Year	Pump #1	Pump #2	Pump #3
1949	none	none	NEW IN 1953
1950	none	none	
1951	none	none	
1952	none	none	
1953	none	none	none
1954	none	none	none
1955	none	none	none
1956	none	none	none
1957	none	none	none
1958	none	serviced	none
1959	none	none	none
1960	none	none	none
1961	none	none	none

Engineered for emergencies and normal, variable demands, three DEMING Turbine Pumps keep pumping costs at a minimum in the modern water works at Richmond, Missouri. Each pump has a capacity of 500 G.P.M. against a 400-ft. head. As the well water has a certain iron content, it is aerated, chemically treated and pumped into a reservoir.

In the event of power failure, the pump direct-connected to the diesel engine takes over to meet emergency demands.

Low Maintenance Costs

Three DEMING Turbines, each with 60 h.p., 1750 r.p.m. vertical motors, meet minimum to maximum load demands at Richmond. Two of these were installed in 1949. Since that time, one of these pumps received a routine overhaul in 1958, otherwise neither pump has needed maintenance. The other DEMING Turbine, installed in 1953, has required no service of any kind.

The many features of DEMING Vertical Turbine Pumps offer practical advantages in water works service. For complete information on the complete line of DEMING pumps for municipal service, write to:

THE DEMING CO.
993 Broadway • Salem, Ohio

its suction from a 2,750-gal. steel tank, which is provided with an automatically operated float valve to prevent a cross-connection between the sewage pumps and the water supply system.

There is a liquid-level recording system to indicate at all times the elevation of the sewage in the suction well. This system consists of a flush-mounted recorder with a strip-type chart, and a 2.7-cu. ft. per min. air compressor, which discharges a small quantity of air continuously out of the bottom of a 4-in. steel air-bubbler pipe. The bottom of this pipe, which is open, extends below the surface of the sewage in the suction well of the station.

Installation of Equipment

The installation of the equipment required the solving of many problems. As the surface of the sewage in the suction-well is several feet below mean low tide, it was necessary to pump sewage at all times. It was also essential that as little sewage as possible be discharged into the harbor, as this body of water is surrounded by many industrial plants and the dilution afforded in the harbor is quite small.

The equipment was installed during three different periods. During the first period the engine-driven mgd mixed-flow pump was installed together with its associated piping and auxiliary equipment. This work was done with a minimum of interference with the operation of the pumping station. After this pump was installed, it was possible to bypass a portion or all of the sewage to the harbor. The second stage of the work consisted of installing one of the 40-mgd sewage pumps. This unit was located in the station where there was no interference with the existing sewage pumps that were to be abandoned. Along with installing the above-mentioned pump and its suction and discharge piping, much of the high-tension electrical equipment that has been previously described was provided. Getting this pumping unit in service presented no great difficulty. At the time when it was necessary to break through the wall between the pump room and the suction well adjacent thereto to install the suction piping to the pump, it was essential that precautions be taken to prevent sewage in the suction well discharging through the opening into the pump room. Fortunately all of this work was done with no untoward results.

It was during the third stage of the work that many difficulties were encountered. For an extended period of time alterations had to be made to the sewage pipes outside of the pumping station. This work required cutting one of the force mains out of service. At times it was necessary to pump some of the sewage to the harbor.

The removal of the three existing steam - driven pumps presented many problems. The least costly and quickest way was to dismantle all three pumps at the same time and raise the dismantled materials to a platform by means of an existing 20-ton overhead crane at the western end of the pump room, from where the material was removed from the building in trucks. Following this procedure entailed some risk in that the contractor doing the work might accidently drop the material on the pumping equipment that was a permanent part of the installation and cause considerable damage. As a protection against this danger a continuous temporary decking, consisting of 12 by 12-in. timbers, was erected over these pumps and the discharge piping from them. During other times when hazardous phases of the project

A new, economical way to pinpoint sewer and water main problems!

Inspect Underground Pipes with APCO TV!

AMERICAN PIPE CLEANING CO.'s new method of closed circuit television inspection of underground pipes is saving municipalities thousands of dollars in locating pipe failures and trouble spots.

APCO's Monitored TV Pipe Inspection effectively pinpoints every defect in sewer and water mains, well casings, conduits, ducts, chimney flues and other pipes not subject to inspection by the human eye.

APCO's special design mobile TV cameras are passed through underground pipes . . . interiors are viewed in precise detail on a TV monitor in the comfort of an air-conditioned viewing room. Distances of trouble spots from manholes are recorded accurately, to within 1 foot! As the TV cameras move through the pipes, movies or still pictures are taken (if desired) to provide a reference for repair and cleaning crews.

Are you planning to repave any streets where underground pipes may be in need of repair?

Tearing up 100 feet of new pavement can be more costly than pre-inspection of 20 city blocks by monitored TV. APCO's TV cameras can locate sources of infiltration, settled pipes, offset joints, structural fractures, excessive root growth and other defects in sewer and water mains.

See an actual demonstration at the APWA show in Minneapolis!

APCO also offers exclusive Planalyzed Contract Cleaning . . . a complete efficient, economical solution to all sewer and water pipe cleaning and maintenance problems.

APCO
Electronics Division

American Pipe Cleaning Company

2231 Edgewood Avenue • Minneapolis 16, Minnesota • LIberty 5-0271

Also exclusive Upper Midwest distributor of OK CHAMPION sewer cleaning equipment.

were being done, the contractor was required to work continuously 24 hr. a day, day by day, until the work was completed. In spite of the many difficulties this phase of the project was finished rapidly and satisfactorily.

Several things were done to rehabilitate the station. One item of importance involved correcting a hazardous condition that had developed over the years. The underside of the gabled roof over the pump room, which was 56 by 182 ft. in plan and was over 70 ft. above the pump room floor, had been originally plastered. From time to time large pieces of this plaster became detached from the concrete roof and fell to the floor below. To have replastered the ceiling would have been most expensive, partly because of its inaccessibility. The procedure adopted to eliminate this hazardous condition was to install a galvanized steel deck-type ceiling by fastening it to the bottom of the trusses supporting the roof. Any falling plaster would then be caught on this ceiling.

The lighting in various parts of the station was modernized. In the ceiling of the main pump room 22 fluorescent lighting fixtures, each containing two 15,000 lumen lamps were installed. Several of the toilet rooms were renovated by installing new plumbing fixtures, providing new metal toilet partitions and lining the walls with glazed tile. The interiors of all of the rooms in the station, except those that were little used, were cleaned and painted.

The cost of modernizing and electrifying the pumping station exclusive of engineering costs was as follows: For the 175-mgd pumping unit, $323,710; one 40 mgd pump, electrical equipment, etc., $296,139; one 25, one 30, one 35 and one 40-mgd pumps, piping, etc., $750,992; metal ceiling in pump room, $11,362; and lights in pump room, $3,345. The total cost was $1,385,548.

Acknowledgments

The sewerage system is under the general direction of Bernard L. Werner, Director of Public Works; Dr. Abel Wolman is consultant. R. J. Trautman, principal engineer, is in direct charge of the station and Henry Becker is the superintendent. Malcolm L. Fallin, civil engineer, assisted in the design of the improvements and was in charge of their installation. Henry Adams, Inc., served as consultant on the design of the electrical equipment and Thomas S. George was the consulting engineer on the design of the mechanical equipment. Logan S. Kerr, consulting engineer, rendered advice relative to certain problems that arose.

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1. Keefer, C. E., "Additions to Mechanical Equipment at Baltimore Sewage-Pumping Station," *Eng. News-Rec.*, 103, 333 (1929).
2. Keefer, C. E., "Venturi Meter 42 Years Old Still in Good Condition," *Water and Sewage Wks.*, 102, 178 (1955).

• • •

Sewage Treatment Results at Coral Gables

The sewage treatment plant at Coral Gables, Fla., during the 1959-1960 fiscal year, with an average flow of 2.98 mgd, removed 95 percent of the BOD and 92 percent of the suspended solids. Gas produced amounted to 0.65 cu. ft. per capita per day of 1.4 cu. ft. per pound of volatile matter destroyed. Post-chlorination was at the rate of 8.1 mg/L, and prechlorination is also employed. Connected population was 15,469. Sludge is filtered and burned. W. C. Tims is superintendent.

Low initial price OR Low final cost

In purchasing a crane-excavator for road construction and maintenance, do you look beyond the low bid figure? You should, because the cheapest buy is not necessarily the best buy. Initial purchase price does not reflect final cost of a machine that must be used, serviced, maintained and repaired for many years. Your best buy is the machine that meets all your production requirements with the lowest final cost.

Dollar for dollar a UNIT crane-excavator gives you more in terms of productivity, low upkeep, and built-in dependability. You get more production with UNIT'S *direct-in-line drive* — a simple, highly efficient power transmission system — and smooth-acting disc-type operating clutches. You get low upkeep with UNIT'S *exclusive one-piece main machinery case* completely enclosing all gears, shafts and bearings. Operating in a constant oil bath, they last longer . . . require less maintenance attention because lubrication is continuous. UNIT gives you built-in dependability, too. *All* spur and bevel gears, worm drives, and rollers are forged for uniform toughness. Shafts are involute splined for greatest strength. Essential working parts are scientifically heat-treated with wear surfaces flame-hardened for long life.

When bids on a crane-excavator are next opened, consider *final costs first.* Do it, and like so many other public officials, you'll choose UNIT. Available on crawlers (½- to 1-yd. size) and on rubber (½- to ¾-yd. size). All models are designed for use as shovel, crane, dragline, trenchoe, or clamshell.

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Best Bidder vs Low Bidder

More than 70 percent of our cities normally award contracts for construction and/or maintenance equipment to the "best bidder" rather than to the "low bidder." In a questionnaire to city engineers and directors of public works by the Editors of Public Works, the question was asked: In buying major construction and/or maintenance equipment, do you award the contract to the best bidder or to the low bidder?

Of the questionnaires mailed out, 22 percent or 1250 were returned; and of these 984 answered this question with 726 reporting awards were made to the "best bidder" and 258 to the "low bidder." Many times, of course, the best bidder was also the low bidder and these figures must be read in that light. It is not intended to intimate that some 70 percent of the cities are defying state laws or sound administrative practices. Instead, the figures show that by knowing what is needed and by preparing equipment specifications carefully, the lowest bid is also often the best bid.

In this connection, some 120 engineers commented more fully on this matter on the questionnaires. In general, these comments can be summarized in a few sentences. In the first place no city is required by law to buy anything it does not need or that is not suited for the work at hand. Quite properly, laws uniformly require that contracts be awarded to the best and/or lowest bidder. It is widely recognized by city engineers and public works directors that the preparation of proper specifications will, in most cases, result in offering equipment that meets the needs and desires of the city. Emphasis is given in many of the comments on the questionnaires on the need for precise and comprehensive specifications. However, in these cases where it is necessary to procure other than the lowest bid equipment, procedures are usually available whereby it can be obtained. In general, however, use of such procedures is recognized as a poor substitute for proper specifications.

• • •

Lighting and Traffic in Montgomery County

In the county-owned system of Montgomery County, Md., there are 53 intersections controlled by traffic signals. The county street lighting system consists of 17,236 units.

BURNING HELPS CONSERVE LANDFILL AREA

WILLARD MORRIS
Sanitation Officer,
Sedalia, Missouri

A 33-ACRE area six miles west of Sedalia, Missouri, has served as the city's sanitary landfill site for a total of more than 14 years. Scarcity of additional suitable locations has made site conservation mandatory.

Purchased in 1947, the now nearly-full field is isolated sufficiently to permit burning for the purpose of reducing total volume, yet near enough to hard surface roads to insure easy access for city trucks, contract and private haulers in all kinds of weather.

Garbage is collected by the four city-owned Gar Wood Load-Packer trucks on a daily schedule from the 80 business places in the city and weekly during the winter months from the 9,138 residences in the city of 28,000. Residential collections are made on a twice-weekly schedule during the five summer months.

Each of the trucks (three of 10-yard and one 13-yard capacity) carries two loads to the landfill operations daily, each load averaging 500 lbs. per yard. Adding considerably to the total volume of burnable trash deposited at the site daily are the broom and shoe factories which form the major share of the city's industry.

Dumped at the edge of the 12 to 14-foot deep, 10-foot wide trenches, the material is dozed into the trench with the city's Caterpillar 977H Traxcavator, then drifted to the far end of the cut, where fire is applied at the end of each day's operations. The trench is left open during the two to three months required to fill the 600 to 700-foot long cuts. At the end of this period, the garbage is covered with three to four feet of compacted earth.

In addition to reducing total volume, burning also tends to hold the bacterial count to a minimum, thus controlling odor. Additionally, repeated movement of freshly-deposited material onto already-burned matter, makes for even greater compaction than would be accomplished otherwise. Daily burning also keeps the modified landfill operation free of rats and other vermin.

The entire cost of operating the municipal collection service and landfill is paid out of the city's general revenue funds. This amounts to approximately $36,000 per year, or $5.53 per ton for pick-up and hauling of the 6500 tons handled annually.

8,700 Tons Annually

With private haulers and the annual cleanup week adding to the above volume by approximately 2,200 tons, the total annual volume of trash and garbage handled at the landfill approaches 8,700 tons. Fuel, depreciation and maintenance of the Traxcavator, plus operator's wages, total approximately $6,450 annually, making cost of disposal at the site about 74 cents per ton.

The landfill is open 24 hours per day throughout the year for the convenience of both contract haulers and individual citizens. It is manned nine hours per day, five days of each week, with the Traxcavator operator directing placement of all loads to assure proper compaction in all areas of the trenches.

All trenches in the landfill are dug north and south but when the new area is opened, after the present one is filled, it will be laid out east to west for better drainage.

In addition to regular garbage collection, the City Sanitation Department conducts a week-long general "Clean-Up" campaign during the late spring months, at which time citizens are urged to place unwanted items of any kind along the alleys for pickup. During this period, regular city trucks follow the garbage collection vehicles to collect materials which cannot be handled by the Load-Packers. The campaign this year resulted in the placement of more than 300 truckloads at the landfill.

The nine-man regular force of the garbage collection department—a driver and helper for each truck, plus the Traxcavator operator—is augmented with four additional personnel during the summer months, the semi-weekly collection schedule dictating sixth-day operation during the five-month summer period.

Prior to purchase of the 977 power shift Traxcavator in August, a Caterpillar No. 6 Shovel had been used on the landfill since 1955. Before that the city had used a Caterpillar D4 Tractor with bucket attachment.

Earthmoving production at the landfill has been approximately tripled by the 977 Traxcavator over that possible with the No. 6 Shovel. Digging the trenches, which are placed as close to previously filled areas as possible, formerly required approximately six weeks, work being done between spreading operations. Digging the 700-foot long trench now in use was accomplished in two weeks.

Courtesy Caterpillar Tractor Co.

● **TRENCH method of sanitary landfill is used; trench is 12 to 14 ft. deep and 10 ft. wide; final cover is 3 to 4 ft., compacted. Amount of refuse is 8,700 tons/year.**

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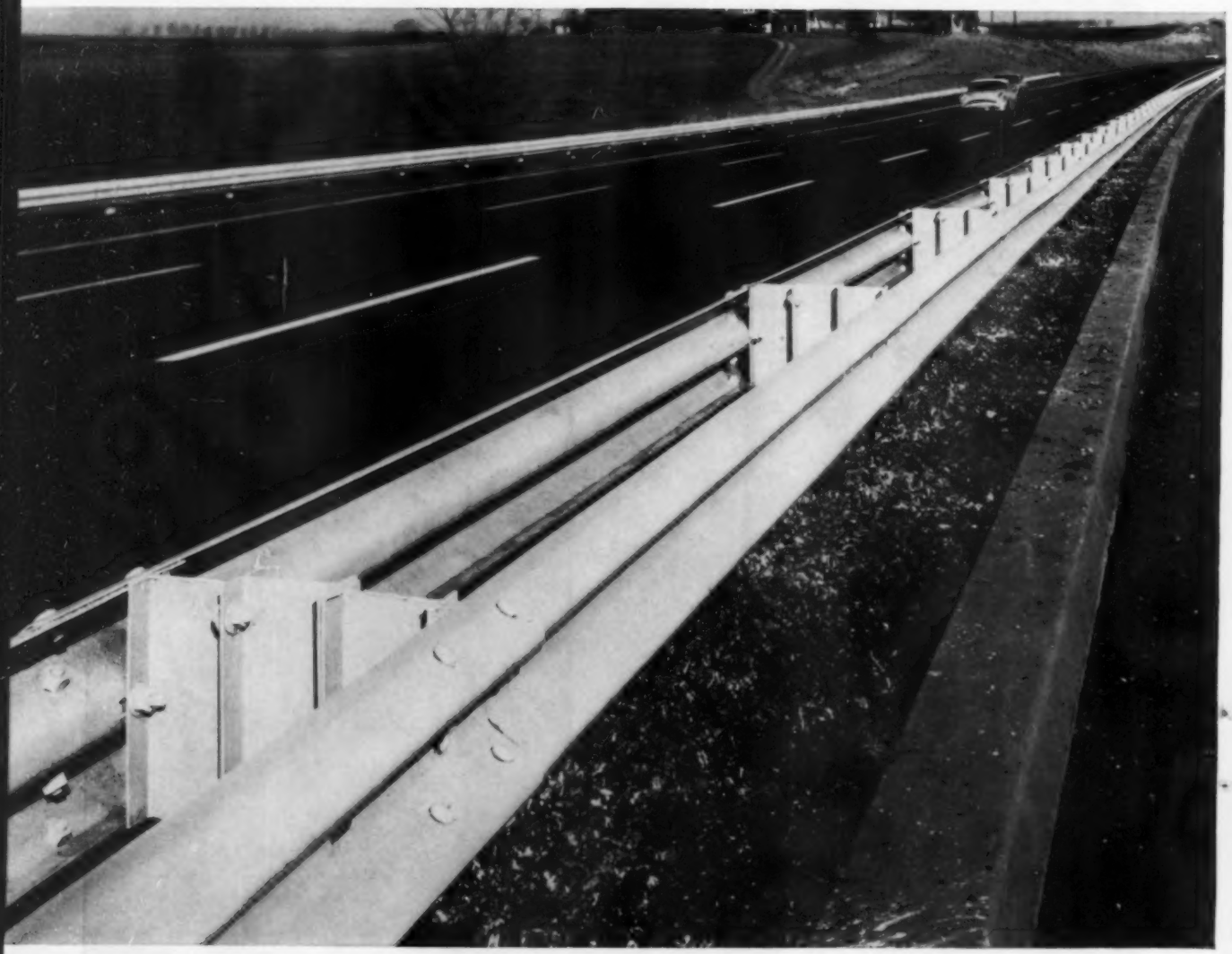
USS AmBridge Highway Beam Guard Rail has been adopted by most state highway departments because it's built *extra-strong* to withstand high-impact forces. And, it's bolted together to *stay* together with tough $\frac{5}{8}$" bolts that conform to ASTM A-307. USS AmBridge Beam Guard Rail will save maintenance money. Paint sticks better because all mill scale is removed *before* forming and all sections are degreased, rinsed, oven-dried and specially primed before painting. USS AmBridge Beam Guard Rail is available in 25-foot lengths for minimum splicing as well as the standard 12½-foot lengths.



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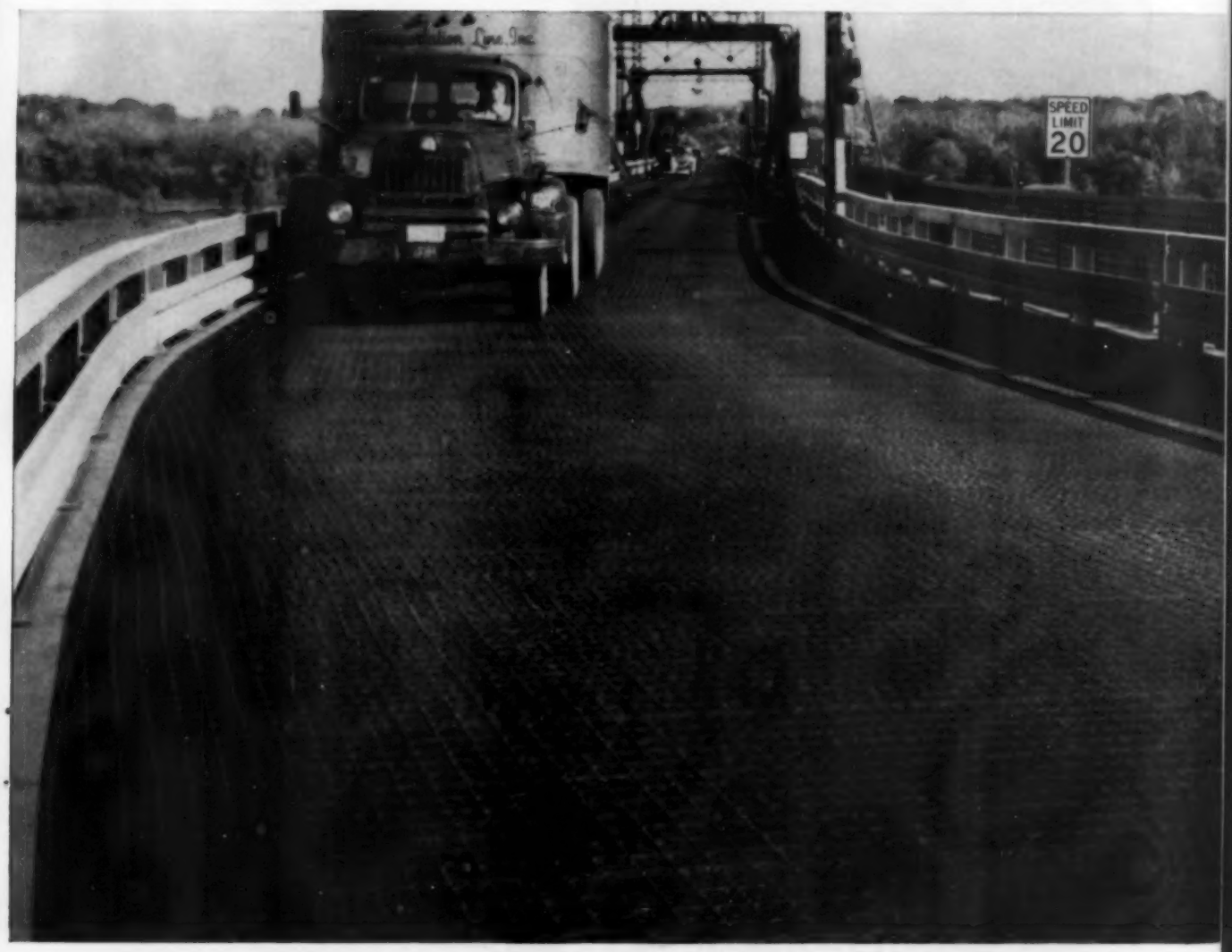

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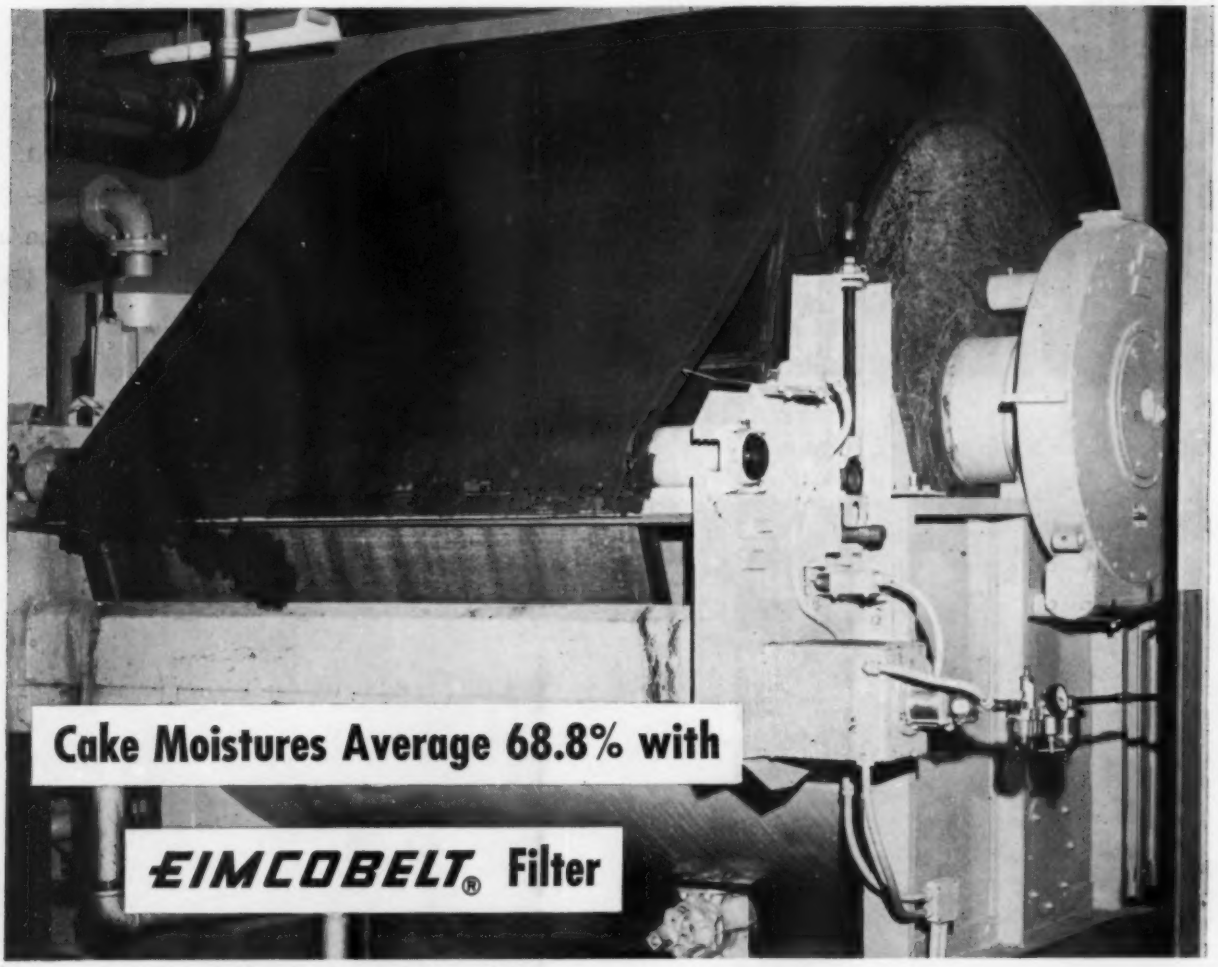

at Logansport, Ind.

Low cake moisture is only one of several ways this EimcoBelt continuous belt filter results in low costs dewatering a primary activated digested sludge at the Logansport, Indiana, Sewage Treatment plant.

Other cost-cutting advantages of the 8-ft. diameter by 6-ft. EimcoBelt filter — complete freedom from filter medium blinding . . . high vacuums . . . low chemical costs . . . ability to discharge thin cakes . . . negligible maintenance. Total sludge dewatering costs at Logansport — $9.80 per ton of dry cake.

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Consulting engineers for Logansport treatment plant: Henry B. Steeg and Associates.

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B-674

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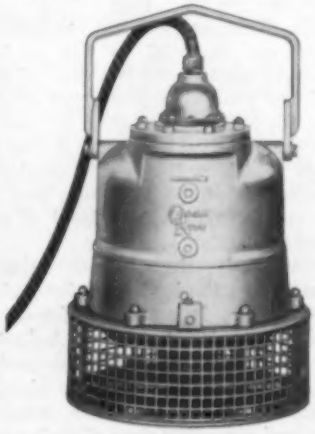

11-3210

Municipal Power

SPECIFYING PROTECTIVE RELAYING

BRUCE J. ENNIS

Associate,
Burns & McDonnell Engineering Co.,
Kansas City, Missouri

PROTECTIVE RELAYS are the devices which detect incipient or developing fault conditions on an electric system and initiate the action necessary to isolate trouble spots from the normal parts of the generation, transmission, distribution and utilization system components. By so doing, they contribute to the continuity of service and the protection of personnel, and minimize damage to electrical equipment, cables, and overhead conductors.

Considering the very large investment required for the overall electric system, and the consumers' demand for utmost reliability and continuous service, the expenditure necessary for suitable protective relaying is relatively insignificant. A $50 relay, properly applied, may save thousands of dollars in damage to a large turbine generator unit during the time necessary to detect and clear a fault condition, over and above the minimum damage which might occur as a result of the fault. A momentary fault on an important feeder may be cleared and service restored with negligible disturbance to the electric system consumers, provided the feeder is equipped with adequate relaying, thus contributing to good public relations on the one hand, and minimizing line burndown, prolonged outages, and loss of revenue, on the other.

On the premise that protective relays are essential in the modern electric system, the problem of specifying a suitable protective scheme for the individual system is resolved by the selection of the particular relays which will furnish maximum protection at the minimum cost required for the desired level of protection.

Obviously, the cheapest relay is not always the best relay for a given application. It is possible, for example, to employ inexpensive induction type overcurrent relays for protection of the bus in a power plant or substation; however, the sensitivity and operating time of such relays do not approach the high speed of response, the sensitivity, and the freedom from false tripping which could be obtained from a more expensive, but more desirable, bus differential or linear coupler type of relay scheme. For important buses requiring protective relaying, it would be much more prudent to specify relays designed specifically for bus protection than to improvise a workable, though unsatisfactory scheme using less expensive relays not geared to the operating functions desired.

In selecting relay systems for any component of the electric system, large or small, consideration should be given to the following basic principles:

1. The relaying should be dependable, and adequate to detect and take corrective measures for all possible types of fault.
2. The relays should be fast in operation, to reduce to the minimum outage time and damage to equipment.
3. The relays and relaying circuits should be as simple as possible to provide: maximum reliability, ease of testing, setting, and adjusting; and minimum first cost and operating and maintenance expenses.
4. The relays should be applied to provide maximum selectivity and service continuity by isolating only the parts of the system subjected to fault conditions.
5. The relay scheme should be designed to permit future additions to the system with maximum flexibility.

In general, the final selection of relays will be the result of a compromise of the above factors, requiring judgment in the application and theory of relaying as well as a knowledge of the complete power system. Such selection must consider: the functional types of relays including alarm, overcurrent, voltage, differential, distance, directional, power, timing, thermal, and power factor relays; the operating time characteristics, such as high speed (0.05 second or less) or slow speed (over 0.05 second); and the types of protection such as generator, transformer or bus differential relays, directional overcurrent ground protection, etc.

Although functional reliability of modern relays is very high, important circuits and large equipment should be provided with back-up relays to assure the tripping of appropriate circuit breakers to clear the fault, even at the sacrifice of selectivity in the limitation of trouble to restricted portions of the system.

The power system may be divided into five protective zones requiring relay protection for each zone, with some over-lapping between the zones. These are as follows:

1. Generators
2. Transformers
3. Buses
4. Transmission and Distribution Lines
5. Motors and Utilization Equipment

In the case of a unit type power plant, the generator and transformer relay zones will be over-lapping; similarly, the transformer and bus relaying should be arranged for over-lapping protection in substations, to provide complete protection within all zones.

In preparing specifications for protective relaying, one-line diagrams should be prepared showing voltages, capacity ratings, and connections of transformers, generators, motors, circuit breakers, and other significant system components. In addition, a relay diagram should be prepared showing the types of relays selected; the number, location, rating, and connection of associated current and potential transformers; and the functional tripping circuitry to associated power circuit breakers. This information, together with detailed and functional specifications for the desired relays will permit the relay manufacturers to quote with a coordinated knowledge of the overall relaying scheme desired.

In cases where directional distance relaying is contemplated, the conductor size, spacing, length, etc., of the transmission lines should be shown on the diagrams to permit selection between short-time (reactance) or long-time (impedance) type of relays.

It is generally good practice to specify electrical trip, hand reset auxiliary tripping relays for all cur-

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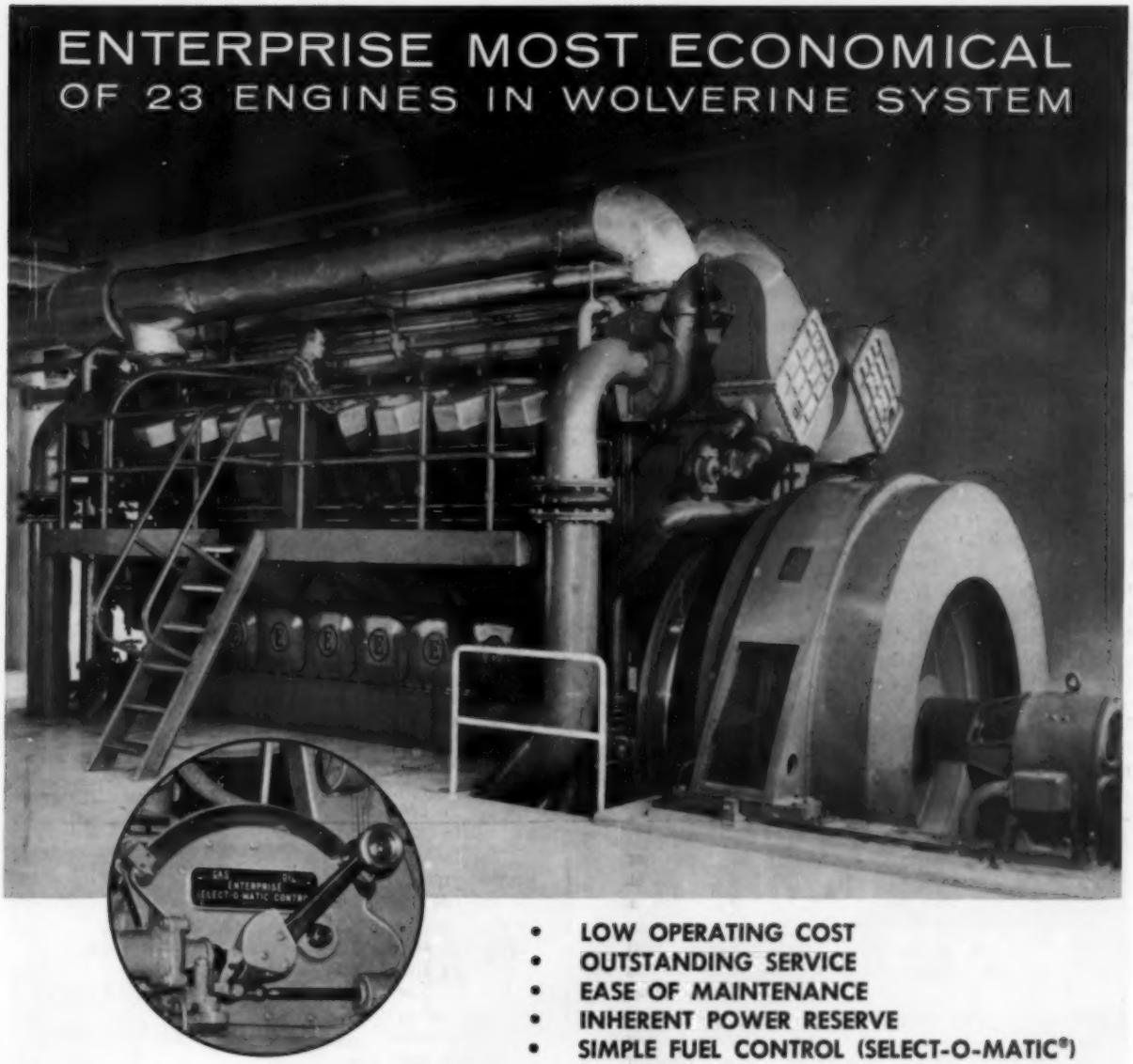

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Wolverine Electric Cooperative, Inc., headquartered at Big Rapids, Michigan, chose this Model DGSRV-16-3 Enterprise 16-cylinder Turbo-charged Dual Fuel Engine to power its Van Dyke Plant at Burnips, Mich., because of low installation cost and Enterprise's enviable reputation for fuel economy in dollars per kilowatt. Read what James O. Wood, Superintendent of Production, has to say about Enterprise economy and performance:

"Our Enterprise engine is one of the most economical in our system, which consists of 23 engines and includes five different makes. We are especially pleased with the operation of the Enterprise 'Select-O-Matic'® controls, and the ease of engine maintenance. Enterprise service has been outstanding."

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rent differential relays. and transformer relays should be of the type which provide high sensitivity for internal faults with freedom from false tripping for external faults or transformer magnetizing inrush currents. Generator loss-of-excitation relays should be provided to trip the generator before it falls out of step due to accidental loss of excitation.

Complete lines of protective relays are available from each of the two principal electrical equipment manufacturers in the United States. In many cases, the functional operation of equivalent types of relays are identical between the two manufacturers. In certain other types of relay protection, different schemes are employed which produce the same end results by dis-similar methods. In preparing relay specifications for a given system, it is often helpful to discuss the desired functions and relay operating characteristics with the manufacturer's representatives to assure specifying the particular type of relay best suited for a specific application, especially in cases of an unusual or peculiar nature.

From the numerous types of relays available for system protection, it is possible to select and specify relays for practically any application. Assuming a medium sized power plant unit type generator, step-up substation transformer, and transmission feeder, a typical protective relay selection might include (among others) the following:

Generator and Step-Up Transformer:

3 Generator differential relays.
3 Transformer differential relays.
1 Transformer overcurrent ground relay.
3 Generator external fault back-up relays.
1 Generator loss-of-excitation relay.
1 Generator neutral overvoltage relay.
1 Voltage balance relay.

Outgoing Feeder:

3 High speed directional distance phase relays.
1 Directional overcurrent ground relay.
1 Connection to substation bus differential relays. □ □ □

• • •

Operational Data at the Gary, Indiana, Sewage Treatment Plant

The activated sludge sewage treatment plant serving Gary, Ind., has been in operation for 20 years. During that time it has averaged 92.3 percent in BOD reduction and has removed an average of 96.0 percent of suspended solids. The 20-year final effluent averages 11.2 ppm BOD. In 1960, the removal of BOD was 94.25 percent and of suspended solids 97.22 percent. Thus, after 20 years of service, this plant is still operating in a highly efficient manner—a compliment to the original designer, to the operating staff and to the city government.

The cost of operation in 1960 amounted to $26.76 per million gallons treated; $1.73 per capita; and $15 92 per 1,000 lbs. of BOD removed. The value of sludge gas used has averaged $59.91 per day over the 20 years of operation; in 1960, 75.82 percent of the sewage was pumped by engines driven by sludge gas.

Raw sewage 5-day BOD in 1960 averaged 216.5 ppm; settled sewage 82.9; and final effluent 12.4. Per gallon of sewage 0.58 cu. ft. of air was used; and 1.032 lbs. of BOD were reduced per 1,000 cu. ft. of air. Suspended solids in the raw sewage averaged 508.6 ppm; in the settled sewage 144.1 ppm; and in the final effluent 14.1 ppm.

The average daily per capita flow in 1960 was 175 gallons. Pumpage averaged 30.09 mgd; the average over the past 20 years is 23.3 mgd.

● **WORKMEN install a double line of steel guard rail on the Pennsylvania Turnpike's median strip. The galvanized guard rail is fastened to H-beam steel posts.**

The Case for Galvanized Steel Guard Rails

IN AN EFFORT to decrease automobile fatalities from head-on collisions on 4-lane roads, engineers are specifying center lane guard rails made entirely of galvanized steel. At this time, such guard rails are being installed in New Jersey, Pennsylvania and Connecticut. Concurrently, rails are also being installed at curves and other danger spots.

An example of protective guard rail produced and installed in an extremely efficient manner is an 80-mile section on the New Jersey Turnpike. According to the Turnpike Authority, galvanized steel was selected because of its safety, controlled flexibility, negligible maintenance requirements, economy and permanence of installation. The Pennsylvania Turnpike Commission has almost completed installation of median galvanized guard rail on the entire length of its principal toll road. The galvanized steel rail costs about $25,000 per mile installed.

In the hot dip galvanizing process, the molten zinc forms an alloy with the steel and results in a tight surface bond which is rugged, resists rough usage and provides a sheath to seal out the corrosive atmosphere. In addition to serving as a tough metallic barrier, zinc provides the steel with a galvanic protection that takes over if small breaks eventually appear in the coating. In the presence of moisture, and electrochemical action takes place whereby the zinc expends itself very gradually, and the exposed steel areas continue to remain uncorroded. The

● **FOR guard rail installations on the New Jersey Turnpike, extra sections of post stock are bolted at top of the posts before rail is placed.**

zinc takes the punishment; the steel is protected.

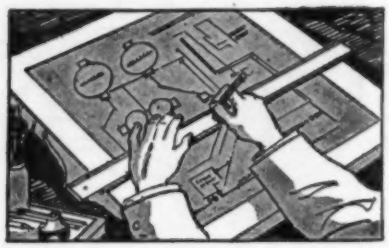
State Highway Specifications

A design possessing the features required for excellent service along highways consists of galvanized steel beam guard rail and fastening elements supported by galvanized steel posts which have been driven into a special foundation.

The center lane guard rail just installed on the New Jersey Turnpike illustrates the type of galvanized product that is being adopted increasingly by other states. Two feet high, the 80 miles of galvanized steel barriers installed on the Turnpike use 10-gauge steel plates, 13½ feet long, one foot wide, corrugated for optimum impact resistance to a minimum standard depth of three inches. The steel stock weighs 9½ pounds per foot. Mounting posts are 69-inch galvanized steel wide-flange beams, with spacers at the top made of 9-inch long sections of the post stock bolted to each flange. When the posts have been driven into a foundation strip to a depth of about 47 inches, leaving 22 inches above ground, the spacer sections are bolted in place. The rail sections are then bolted to the spacers on both sides of the post. Spacing is 12½ feet to accommodate the rail length effectively. The foundation strip is a 36-inch wide channel, 3 inches deep, filled with small stone which is tarred and rolled prior to driving in the posts. All mounting hardware is also of galvanized steel for optimum corrosion resistance. Rail elements overlap 1 foot in the direction of traffic, thus eliminating the possibility of an out-of-control car catching the edge of a strip and pulling it away. The final assembly of rail sections produces a smooth, continuous center line that can be seen readily at night, whether unpainted or painted white to harmonize with surrounding terrain.

The New Jersey Turnpike Authority assigned the installation of the guard rail to Whitmyer Bros., Inc., of Folsom, New Jersey. Zinc coating specification was set at 2½ ounces of zinc per square foot of steel surface, a requirement that has proven highly effective for long-term corrosion protection. New Jersey Galvanizing & Tinning Works, Inc., of Newark, New Jersey, assigned the contract for hot dip galvanizing the steel rail components, controlled production to apply an amount of zinc substantially in excess of the specified 2½ ounces, thereby extending even further the corrosion-free life of the rail. □□□

CONSULTING ENGINEERS



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Detroit Solves Transportation Problems

(Continued from page 101)

the problems inherent when handling large volumes of earth excavation. The matter of air and street sanitation and cleanliness during the construction periods and of traffic dislocation, both through residential and commercial areas, is not to be ignored. While this is a transitory problem it is a very real problem to the abutting property owners and others most intimately concerned. The city must make every effort to minimize these problems. It is here that the patience of all persons connected with such a program, both public and private, will be tried to the utmost.

We are determined that our master plan of expressways, which will cost about $1-billion, will be built now, not 20 years from now. We are satisfied that these expressways are planned and designed to handle safely, speedily and efficiently, private transit and trucking, as well as public transit. Rail transit enthusiasts have had every opportunity to convince Detroit that rail transit facilities were necessary in order to handle mass public transportation satisfactorily. So far they have failed to do so. For over thirty years Detroit has had a rapid transit commission, made up of outstanding engineers, business men and industrialists. Several studies have been made by this commission. Under our charter, any transit system for the city must be paid for out of transit revenues. No subsidy is allowed. The studies have not been able to produce a rail rapid transit plan that could be built and operated without subsidy.

Detroit is quite unique in that 75 percent of our citizens travel to and from work in their own private cars, in spite of the fact that we have always had a transit system which compares very favorably with other metropolitan areas. Buses spread out over the entire region and no one has to walk more than a few blocks to reach a bus line. The department of street railways has always been recognized as having as modern and comfortable equipment as there is on the market. It is the opinion of many authoritative people in Detroit, including the manager of the Detroit transit system, that the percentage of our citizens using their own private cars would change very little no matter how much we might improve our transit system. People

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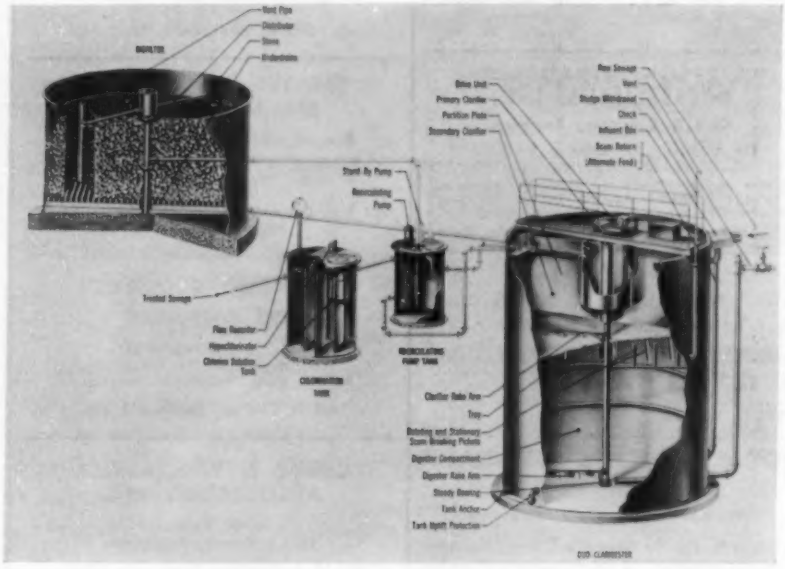

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Dorr-Oliver Inc., Stamford, Connecticut.

Circle **No. 9-1** on the convenient reply card facing page 34.

Truck Tire

The Duplex tire has several economic advantages over the familiar duals it is designed to replace. Fleet owners will be able to reduce inventories with one tire replacing two, and less maintenance should be required because there will be only half as many tires and rims on a vehicle and the need for wheel spacers will be eliminated. There is a reduction in the weight of a vehicle equipped with the tires, permitting heavier payloads. From a safety standpoint, the Duplex provides good brake service because a large part of the brake drums is exposed to the air and overheating is curtailed. In addition, the Duplex eliminates the possibility of continued driving when one of the tires is flat, which could cause fire to break out through the buildup of additional heat.

The Firestone Tire & Rubber Company, 500 Fifth Avenue, New York 36, N.Y.

Circle **No. 9-2** on the convenient reply card facing page 34.

Well Strainer

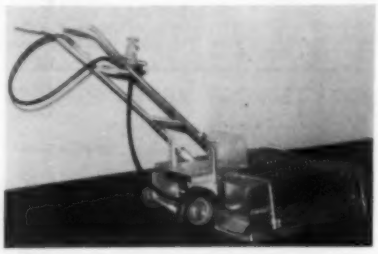
In gravel wall well installations, wire wound well strainers, made with a V-shaped self-cleaning slot, provide continuous sand-free water without clogging. Larger inside than outside the V-shaped slot permits maximum development. After development only clear water is allowed to pass through. Made of drawn wire wrapped spirally around skeleton bars for support, virtually the whole circumference of the strainer is able to receive water.

Cook Well Strainer Co., 6330 Glenway Ave., Cincinnati 11, Ohio.

Circle **No. 9-3** on the convenient reply card facing page 34.

Patching Heater

The Model HE-PR-32 Infra-Red asphalt patching heater is designed for use in removing push-ups, drying asphalt before patching and a wide variety of other asphalt heating chores. The LP gas fired unit operates on an infra-red principle. Three heating tubes emit infra-red radiation which is reflected by three parabolic reflectors onto the surface



to be heated. With this new method of surface heating, no flame touches the material being heated, therefore eliminating burning, scorching and other material damage. The heater is built for one-man operation and features a rack for the LPG tank. Standard equipment includes a pressure regulator and lighting torch.

Aeroil Products Company, Inc., 69 Wesley Street, So. Hackensack, N.J.

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Circle **No. 9-5** on the convenient reply card facing page 34.

Chlorine Analyzer

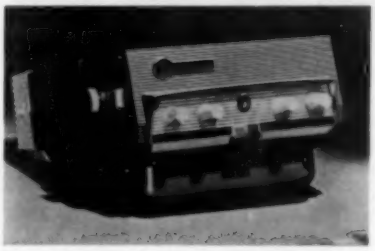
An analyzer for measurement and/or control of free or total chlorine residuals in water supplies and sewage effluents, the Anachlor amperometric-type analyzer is comprised of an analyzer unit and a potentiometer indicator or recorder calibrated in ppm chlorine residual. The two components occupy indentical housings that can be mounted flush on a panel or can be installed separately from each other. The unit can be used for continuous measurements of chlorine residuals in water treatment plants, distribution systems, sewage treatment plants, swimming pools and in industry where process water must be chlorinated but where overchlorination might harm the product or process.

Fischer & Porter Company, 929 Jacksonville Rd., Warminster, Pa.

Circle **No. 9-6** on the convenient reply card facing page 34.

Mobile Radio

This mobile two-way radio is described as the first transistorized unit to provide dual-frequency listening through a common receiver, minimizing extra battery drain. The new transmitter-receiver contains the "front-end" portion only of the second receiver. The RF amplifier and oscillator output of the second receiver is connected to the first receiver's high IF amplifier input. Use of the "dual front-end" concept in transistorized mobile radio equipment meets the needs of municipal systems whose operators require

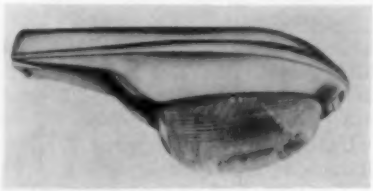


only one transmitter for their own messages, but who want to listen to sheriff's frequencies or a state frequency, too.

Section P, General Electric Communications Products Department, P. O. Box 4197, Lynchburg, Va.

Circle **No. 9-7** on the convenient reply card facing page 34.

Mercury Luminaire

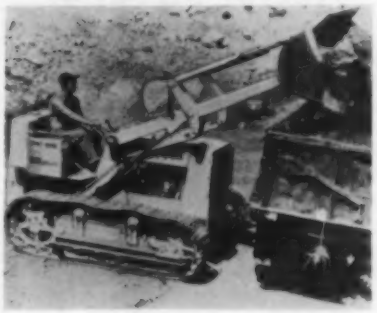


The "Unitized Endoval," 2600 Series luminaire is designed for wide, heavily travelled streets and is offered with or without built-in constant-wattage or high-power-factor reactor ballasts. It is also available with a mounting adapter for EEI-NEMA standard plug-in locking-type photo-electric control. The Unitized Endoval uses 250 or 400-watt mercury lamps to provide high-level, glare-free lighting. Adjustable socket positions produce ASA-IES Types II, III, or IV with proper choice of lamp. The unit is designed to fit either 1¼-inch or 2-inch pipe mounting arm.

Revere Electric Mfg. Co., 7420 Lehigh Ave., Chicago 48, Ill.

Circle **No. 9-8** on the convenient reply card facing page 34.

Crawler Tractor



The 1961 models of the Oliver OC-9 crawler tractor and companion OC-96 loader, feature a number of design improvements. Among the adaptations are vibration-absorbing mountings for radiator, main-frame and transmission case welding design, brake linings, aluminized muffler, transmission snorkel tube design for steep slope operation and warning safety devices for brakes and ignition switch.

Oliver Corporation, 400 W. Madison St., Chicago 6, Ill.

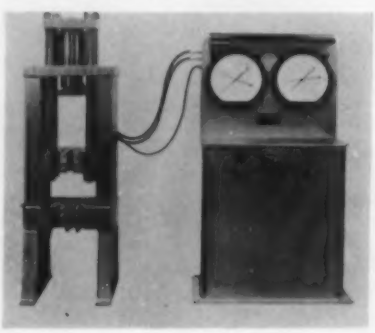
Circle **No. 9-9** on the convenient reply card facing page 34.

Testing Machine

The Forney Model LT-800 is standard equipped for testing reinforcing bars from Nos. 2 to 11 inclusive in tension and 6″ x 12″ cylinders in compression. The standard model is a dual range console type machine with a maximum capacity of 250,000 lbs. A heavier model, LT-900, has a capacity of 400,000 lbs. Metric gages are optional. Accessories adapt the machine for testing cubes and masonry units in compression, bricks in compression and modulus of rupture, beams in transverse loading and weld specimens in bend and tension.

Forney's, Inc., Tester Division, New Castle, Penna.

Circle **No. 9-10** on the convenient reply card facing page 34.

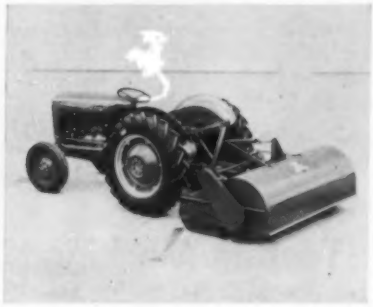


Tractor Sweeper

A tractor-mounted sweeper with a collecting pan, the Young sweeper is designed for use with the lightest model utility tractor utilizing standard 3-point hookup. It has a 30″ diameter 6-ft. wide standard broom. The operating speed of the broom is 120 rpm. The sweeper is fully controlled by the driver from the tractor seat. The operator lowers the broom to sweeping position and when the pan is full he raises it and takes it to the dumping location where the pan is easily emptied without leaving the tractor. Capacity of the pan is approximately 12 cubic feet.

The Young Company, 200 Mill Street, Waco, Texas.

Circle **No. 9-11** on the convenient reply card facing page 34.



Earth Borer

This is an earth borer that converts the Holan HV Elbow into an all-purpose utility tool; the specially-designed attachment near the end of the lower boom accommodates the Holan 5400, enabling the unit to bore holes as far as 13½ feet from either side of the truck body. Because the Elbow rotates 360° continuously in either direction, the digger and derrick can be operated behind and on either side of the truck.

Holan Corporation, 4100 West 150th St., Cleveland 35, Ohio.

Circle **No. 9-12** on the convenient reply card facing page 34.

Waste Collection

The Westvaco refuse system utilizes special paper bags instead of metal garbage or refuse cans. The bags, which hold more than the average can, are held in a metal frame off the ground and are easily removed and replaced. The bags are not affected by rain, wet refuse, broken glass or metal and are claimed to prevent fly production and odors. Lids cannot be displaced by animals. On collection days, the collector removes the used bag and leaves a new one under the holder lid. Putting the new bag in place is easy. With this container, no washing, lining or prewrapping is needed.

Low initial and operating costs, with speeding up of collection schedules, are claimed.

Westvaco Refuse System, West Virginia Pulp and Paper Co., 230 Park Ave., New York 17, N. Y.

Circle **No. 9-14** on the convenient reply card facing page 34.

Service Body

The Highway HSB general service utility body is designed for municipal, utility, contractor repair and other service-type operations. Body dimensions are 90″ long, 77½″ wide, 42″ over-all height, 29″ from floor to top. Depth of side boxes is 14½″ and inside floor space is 90″ x 48½″. The body is equipped with a hinged tailgate with chain and hooks for positioning and locking. Sliding-type roof and ladder racks are optional. Available in 1/2 ton, 3/4 ton and one ton models.

Utility Division, Highway Trailer Industries, Inc., Stoughton Wis.

Circle **No. 9-13** on the convenient reply card facing page 34.

Flow Meter

The metal-tube Varea-meters are used at temperatures and pressures beyond the range of the glass-tube type and for handling hazardous materials. They are supplied with ASA 150 and 300-lb. flanges and conform to ISA Recommended Practices. Meters, supplied in a variety of materials to handle a wide range of industrial chemicals, are made in tube diameters from 1/2-inch to 3-inches. Water capacities range from one to 400 gpm and air capacities from 4.2 to 1680 scfm.

Wallace & Tiernan Inc., 25 Main Street, Belleville 9, N.J.

Circle **No. 9-15** on the convenient reply card facing page 34.

Rail Maintainer

A unique machine designed to wash guardrails, scrape off old paint, and repaint guardrails of all types, the Guardrail Maintainer consists of five separate components. The Maintainer is designed to perform one operation at a time, while being propelled by a vehicle. If the guardrail is to be washed, the washing attachment hooks up to the boom at the front of the truck and quick connect water lines are engaged. The truck then drives along the rail with the washer in operation. To remove old paint, the brushes in the washer are replaced with heavy duty wire brushes. For painting, paint is applied by a special carrier assembly similiar to the washer. An air operated hydra-spray unit complete with hoses, controls, guns and paint container, is included. The fifth unit that makes up the complete machine is the 675-gallon water tank and the supporting power-pack. This unit is carried on the back of the truck or on a trailer.

Ross and White Company, 400 West Madison Street, Chicago 6, Illinois.

Circle **No. 9-16** on the convenient reply card facing page 34.

Litter Collector

The Tecorp Collector vacuums leaves, twigs, small branches, trash and paper by guiding the snout along the street, gutter or side curbing. A driver and one helper to handle the vacuum hose are all the crew necessary. This mounted and self-contained unit fits above the cab of the Truxmore Pakker and becomes an integral part of the collection unit. It has the added feature of being able to load, on the same trip, large bundles of brush or limbs or long branches through the opposite side of the body by opening the side door. The unit can be unbolted from over the cab for storing during the seasons when leaves are no problem.

Truck Equipment Corp., Richmond 35, Virginia.

Circle **No. 9-19** on the convenient reply card facing page 34.

Time Switch

A program control switch, the Model 8003SKL is a 3-dial program control run by a single motor. The unit is designed to replace three separate time switches needed for daily flash and system dial selection. It has three 24-hour dials, each controlling an individual SPDT switch, all synchronized by the one timing motor. For installation, no special housing or drilling is needed. The unit is supplied with special mounting holes in the bracket to accommodate any controller.

Tork Time Controls, Inc., Mount Vernon, New York.

Circle **No. 9-17** on the convenient reply card facing page 34.

Air Compressor

This 21 hp. vehicle-mounted air compressor, designated the IT 8, delivering 78 cubic feet of air per minute and designed to draw its power supply from the vehicle engine, is a two-cylinder, two stage, single-acting, air-cooled, V-type machine with intercooling between stages. Equipped with a steel frame for bolting to the vehicle, this compressor is intended for rear mounting to the Willys Jeeps CJ-5 and CJ-6 as well as for center mounting to the FC-150 and FC-170.

Atlas Copco, Inc., 545 5th Ave., New York, N. Y.

Circle **No. 9-18** on the convenient reply card facing page 34.

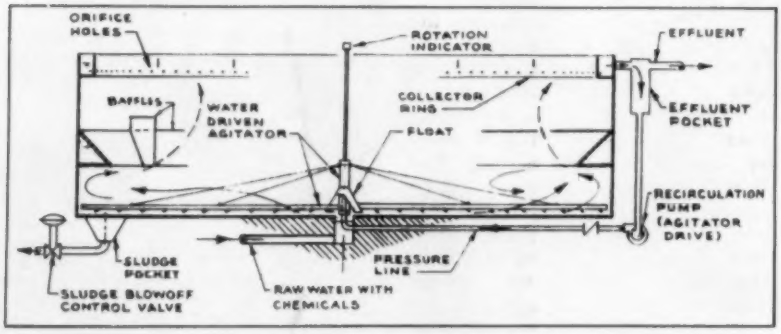
Rotary Mower

A 48-inch three-blade rotary mower designed for mounting on Gravely tractors, this heavy-duty unit has application in tollway and expressway mowing, military installations, cemeteries, golf courses and industrial lawn maintenance. Swivel construction allows the cutter blades to follow ground contours providing an even cut over difficult terrain. Side runners eliminate scalping under all but the most severe conditions. Height of the cut can be adjusted from 1 to 3 inches in half-inch steps. The mower can be equipped with a mulcher for pulverizing leaves during fall mowing.

Pennington Mfg. Co., Addison, Illinois.

Circle **No. 9-20** on the convenient reply card facing page 34.

Jet-Driven Clarifier



A sludge blanket type clarifier, designated the type M Precipitator, uses the effect of water ejected from the tips of the agitator as the sole driving power required for the agitator unit. This design eliminates electric motors and catwalks and bracing. The agitator rotates on a stub spindle and requires no overhead support. In operation, raw water and chemicals are pre-mixed and introduced to the Precipitator tank beneath the agitator hub. A conical deflector, on the agitator hub, directs the water-chemical mixture outward across the tank bottom. Reaching the tank wall, the fluid mixture tends to rise but is redirected back to the center by a horizontal baffle on the tank wall. The type M Precipitator may be installed in existing round basins as well as new tanks. Units will be built for flow rates from 150 gpm to 7000 gpm, diameters from approximately 10 feet to 100, and depths from 12 to 16 feet.

The Permutit Company, Div. of Pfaudler Permutit Inc., 53 West 43rd Street, New York 36, N.Y.

Circle **No. 9-21** on the convenient reply card facing page 34.

Pipe Repair Clamp

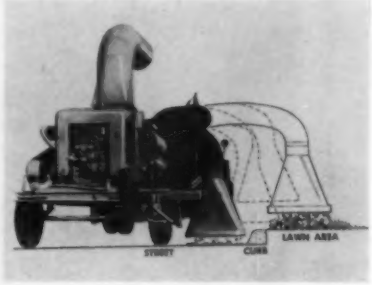
A wrap-around pipe repair clamp featuring bolts on one side and a thick, butt-seal rubber gasket, the Dresser 360 all-around clamp provides an adjustment on diameter so that a single clamp will fit a large number of pipe diameters. The clamp is used for the repair of cast-iron, asbestos-cement and steel pipes with diameters falling within the adjustment range of each clamp. Designed for the repair of holes, circumferential breaks or splits, the adaptability of the clamp permits its use on both the rough barrel or machined ends of asbestos-cement pipe, and on the run of cast-iron and steel pipe. In addition, it may be used where pipe ends are deflected up to 4° or offset ⅛". A sectional lug and the gasket design allow use of the clamp to join pipes of up to ¼" difference in outside diameter. An extra thick spanner plate supports the gasket so that pipes may be connected with as much as a 1" gap between pipe ends.

Dresser Manufacturing Division, Dresser Industries, Inc., Bradford, Pennsylvania.

Circle **No. 9-22** on the convenient reply card facing page 34.

Leaf Loader

A vacuum leaf loader with an hydraulically-controlled nozzle, the model number LL-HCN permits collecting leaves from the grass areas above curbs with no damage to the lawn or to any planting. The nozzle can be made to hover above this area. Automatic nozzle tripping design prevents damage to nozzle and/or object encountered. The operator, who rides in a seat behind the nozzle, controls both vertical and lateral motion by a single airplane-type stick handle. Basically similar to an oversize vacuum cleaner in operating principle, the loader can be used for sewer ventilation, dusting, spraying, blowing, cleaning of materials like salt, cinders, straw and debris from roads and the collection of waste from refuse containers.



Gledhill Road Machinery Co., Galion, Ohio.

Circle **No. 9-23** on the convenient reply card facing page 34.

Density Tester

The Volutester is used to measure the density of soil in the field by accurately measuring the volume of a hole using the so-called balloon density method. This method consists of completely filling a hole by pumping water into a balloon which closely conforms to the contour of the hole. The amount of water necessary to fill the balloon is measured on a graduated cylinder. Features of the Volutester Model I are a set of outriggers for the operator to kneel on to hold the unit down while exerting pressure; an unbreakable graduated plastic cylinder; a bicycle-pump; a pressure equalizing-type valve. The instrument is used primarily in soil testing in conjunction with road building when it is necessary to determine whether the soil has received sufficient compaction to meet specifications.

Testlab Corp., 2734 N. Loramie, Chicago 39, Illinois.

Circle **No. 9-24** on the convenient reply card facing page 34.

Odor Monitor

The continuous odor monitor for water supplies, developed originally by H. H. Gerstein for use at the Chicago South District Filtration Plant, is now a manufactured item which incorporates the basic principles of the original equipment. Water is heated to 140°F in a stainless steel tube containing 2000-watt heating elements after which it is atomized inside a glass jar. A nosepiece inserted into the jar permits detection of any odor bearing substances. Flow is continuous, the spray nozzle releasing about 0.2 gpm. The temperature can be manually controlled by means of a rheostat, and a thermal cut-out is provided to prevent overheating. Principal application is for instantaneous detection of odor levels in raw and finished water supplies and to reduce the number of routine threshold laboratory tests required.

Edgewater Equipment Corp., 5555 North Sheridan Rd., Chicago 40, Ill.

Circle **No. 9-25** on the convenient reply card facing page 34.

Fire Extinguisher

Fire protection for homes, autos, boats or any similar location is available with the compact Merrimac extinguisher. With a replaceable shell and listed by Underwriters' Laboratories, it is also approved by the U. S. Coast Guard. The throwaway shell is cylindrical and contains 2¾ pounds of dry chemical. Spare charges, factory filled and sealed, can be stored nearby so there will be no interruption in fire protection. The shells remain fully charged indefinitely.

Ansul Chemical Company, Marinette, Wisconsin.

Circle **No. 9-26** on the convenient reply card facing page 34.

Safety Switch

A water level safety switch, preventing pump damage due to insufficient liquid at the source or when pump loses its prime, is designed for installations where bearings, packing glands and motor windings depend on pumped water for lubrication and cooling. The device senses liquid flow by measurement of discharge pressure and automatically shuts the system down when water level gets too low. The water level safety switch mounts on the pump discharge line and is connected, in series, with the pump motor power supply. If after a predetermined period of time, pump discharge is not at a specified pressure level, a microswitch electrically disconnects the pump motor, stopping the system.

United States Gauge Division, American Machine & Metals, Inc., Sellersville, Pa.

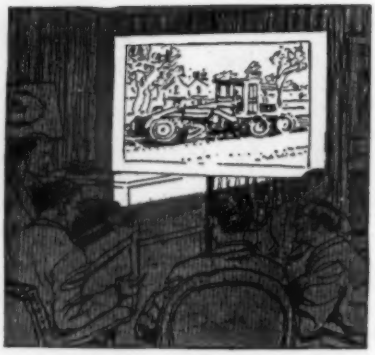
Circle **No. 9-27** on the convenient reply card facing page 34.

Marking Machine

The "Two-or-One" Florline combines two independent machines that may be used together or separately, by one operator or two as manpower dictates. The 5-gallon Florline rolls safety and parking lines with no mist hazard to cars or stock; makes lines flush to barriers and vertically up curbs or wall. The companion unit is composed of a 3 hp Briggs & Stratton Engine, piston-type compressor and spray gun. Combined, a single operator can complete both marking and spraying jobs, before moving to the next area.

H. C. Sweet Company, New Hudson, Michigan.

Circle **No. 9-28** on the convenient reply card facing page 34.



FILMS in Brief

Listed below are motion picture films of current interest to engineers, administrators and supervisors in the public works field. The companies providing these films have indicated that the films are available for appropriate use by PUBLIC WORKS readers. Requests for films should be made direct to the company listed with the film.

"The Big Lift." A general presentation of Lima equipment on construction jobs. (29 min., color, sound) Baldwin - Lima - Hamilton Corporation, Construction Equipment Division, Lima, Ohio.

"Pipe Lines for Posterity." Deals with the manufacture, installation, quality control and research involved in large diameter, high pressure, prestressed concrete embedded cylinder pipe. (28 min., color, sound, 16 mm.) Lock Joint Pipe Company, P. O. Box 269, East Orange, New Jersey.

"Jonah and the Highway." A dramatic story of the highway engineer and contractor and the part each plays in building today's modern highways. (27 min., sound, 16 mm.) Film Distribution Center, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

"The Miracle Called Water." Describes the Springfield, Mass., water system, with narration by Lowell Thomas. Produced by Bay State Films, Inc. of Springfield, Mass. Available on loan from Peter C. Karalekas, Chief Engineer, Water Works, City Hall, Springfield, Mass.

"An American Landmark." The story of a 1,500,000 gallon elevated steel tank and how it rose to help solve a progressive city's water storage problem. (20 min., color, sound, 16 mm.) Chicago Bridge & Iron Company, Public Relations Department, 332 South Michigan Avenue, Chicago 4, Illinois.

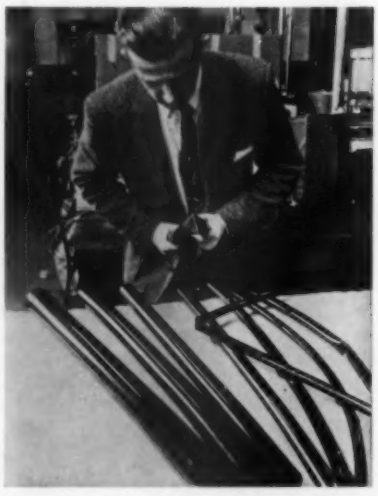
"Modern Sewers for Modern Communities." Installation techniques discussed, features cited and situations portrayed to show K & M asbestos-cement pipe in gravity sanitary sewer systems. (30 min., sound, 16 mm.) Pipe Sales Department, Keasbey & Mattison Company, Ambler, Pennsylvania.

"Dust Costs Money." The use of calcium chloride in treating roadways surfaced with soil, slag, gravel or crushed stone. Solvay Process Division, Allied Chemical Corporation, 40 Rector Street, New York 6, N. Y.

"Topsoil Unlimited." The process of drying sewage sludge for use as a soil conditioner. (20 min., color, sound, 16 mm.) Combustion Engineering, Inc., 200 Madison Ave., New York 16, N. Y.

"Pure Water." Demonstrates need for sewage treatment and describes typical treatment plan. (20 min., black and white, sound, 16 mm.) Dorr-Oliver, Inc., Stamford, Connecticut.

"What Kind of Pipe Should I Buy?" Answers questions commonly raised by persons interested in polyethylene for cold water piping and deals with subjects of density, standards, tests, and comparable costs. (14 min., color, sound, 16 mm.) Plastics Division, Allied Chemical Corporation, 40 Rector Street, New York 6, N. Y.



Testing scene in "What Pipe to Buy."

"The Pump With a New Twist." The design and operation of the Wemco Torque-Flow pump using drawings and cut-away and transparent models. (23 min., color, 16 mm.) Wemco Division of Western Machinery Company, Sales Promotion Department, 650 Fifth Street, San Francisco 7, California.

"Safety in Highway Surveying." The functions of a highway survey party are shown with the hazards and appropriate precautions for working in rough country, dense vegetation, timberland and mountainous country as well as along the highway. (25 min., color, sound, 16 mm.) Photographic Services, Bureau of Public Roads, Washington 25, D. C.

"Signs Take a Holiday." Tracing the history and importance of basic highway signs, with special emphasis on grade-crossing signs. Produced by the Railroad Highway Traffic Safety Committee of the National Safety Council. (black and white, sound, 16 mm.) Association Films, Broad and Elm, Ridgefield, New Jersey.

"Standard Laboratory Control of Soil-Cement Mixtures." Current ASTM - AASHO laboratory test methods for determining quantities of cement and field control factors necessary for building soil-cement pavements, including latest short-cut test methods for sandy soils. (color, sound, 16 mm.) Portland Cement Association, 33 West Grand Avenue, Chicago 19, Illinois.

LARGEST FILTRATION PLANT

We keep reading in your journal about the World's Largest Water Filtration plant being in Chicago.

We do not wish to detract from the capabilities of Chicago's future water plant, but until it is completed and placed in operation, "The World's Largest Water Filtration Plant" has only one meaning in Detroit. In our opinion, it is the Springwells Station of the City of Detroit Water System; it is presently in operation and has a total filter area of 117,372 square feet. This station is the largest of three complete filtration and pumping plants now operated by the Detroit Department of Water Supply. Another plant, the "Southwest Station," is under construction but may not be completed for several years. Designs are being made for a fifth water treatment plant for Detroit which will be located near Lake Huron.

In summary, the capacities of Detroit's filtration plants are:

Plant	Maximum Rated Capacity —M.G.D.
Water Works Park	395
Springwells Station	540
Northeast Station	240
Present Total	1175*
Southwest (under construction)	150**
Lake Huron (in design stages)	250**

*Rated on a basis of 5 M.G.D. per filter bed
**Initially

E. M. Rasinen
Public Relations
Dept. of Water Supply
Detroit, Michigan

SCHEDULED REPLACEMENT OF EQUIPMENT

I have read with interest the "Editor's Point of View Article" specifically "Common Sense in Public Works Equipment Replacement," in the July issue of your magazine.

In our Village, we are starting to set up a cost control system on the replacement of motor equipment. It would be appreciated if you could furnish us with data that you compiled showing what equipment in most cases should be replaced in a five year cycle along with a list of Cities and Counties.

I fully realize that I am asking for a lot of data on this subject. If it is at all possible I would appreciate any information that you can furnish me.

F. F. Wilcox,
Supt. Public Works,
Lynbrook, N. Y.

Ed. Note: We will be glad to receive information from our readers on the establishment of a control system for replacement of public works equipment. Send your data to The Editor, Public Works Magazine, Ridgewood, N. J.

INDEX OF ADVERTISEMENTS

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PUBLIC WORKS JOURNAL CORPORATION

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Regency House
1 Warwick Street
Norman F. Keenan

WORTH SEEING

Runways at New York's Idlewild and LaGuardia Airports will be kept clear of snow by nine new Snowblast rotary plows ordered by the Port of New York Authority from American Snowblast Corporation of Denver, Colo.

Refuse dumped in the new sanitary landfill area in the center of New Braunfels, Texas, is spread by an IHC Drott TD-15 owned by the municipality. The Four-in-One unit cleared the site and handles all landfill work.

Tree trimmings and loose debris in the City of North Miami, Florida are loaded out by this Model H-30 "Payloader" tractor-shovel. The machine, used primarily for maintenance work, has 3000 lbs. capacity.

Growth-retarding chemical mist rolls over the grass at this roadside scene. Use of the chemical, which was developed by the U. S. Rubber Co. Naugatuck Chemical division, reduces roadside mowing cost.

Five of 22 3-wheeled utility vehicles purchased by the City of Philadelphia for use by several of the city's departments.

by Arthur K. Akers

★ **James J. Wall, Jr.,** named general sales manager, Electric Machinery Mfg. Co., Minneapolis, succeeding the late **H. W. Forschner.**

★ **Dr. J. V. N. Dorr** elected "director emeritus" of the Dorr-Oliver board. Now 89, Dr. Dorr remains active in the affairs of The Dorr Foundation and Dorr Associates, Inc.

Dr. Dorr

Mr. Marold

★ **Frank Marold,** vice-president Griffin Pipe Division, has added the title and responsibilities of assistant general manager to his former status. **W. R. Colton** becomes sales manager, headquartering at Council Bluffs, Iowa.

★ **Gordon V. Anderson** is appointed general manager and **Jack Ranous** sales manager, Mitts & Merrill, Inc., Saginaw, Mich.

★ **M. H. (Mike) Foley** rounds out a 33-year service record with Hersey-Sparling Meter Co., and retires as their Chicago branch manager.

★ We lose an old friend in the passing in his 81st year of **Roy B. Everson,** president, Everson Mfg. Corp., Chicago. The corporation advise us that they will continue in business.

★ **Charles C. Warne, Jr.,** appointed sales assistant to the vice-president, Rockwell-Standard Corp. Among his responsibilities will be sales operations of the wholly-owned subsidiary Kerrigan Iron Works Co., Nashville, Tenn., manufacturers of gratings and lighting and traffic signal standards and supports.

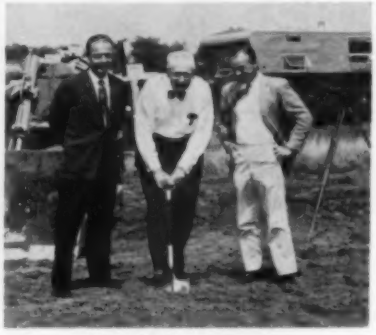
★ **Vernon Pray** is advanced by Schield Bantam Co., Waverly, Iowa, from sales development manager to domestic sales manager. **James Lynch** becomes advertising manager, succeeding **Don Waack,** gone to Bucyrus-Erie Co.

★ Smith-Blair Co., South San Francisco, keeps expanding; this time a new plant in Texarkana, Texas, with **Richard A. Ball** as manager, Texas Operations.

★ **T. L. Kinch** becomes advertising director of Hamilton Kent Mfg. Co., Kent, Ohio, coming from the Ralph Gross Advertising agency in Akron.

★ **Arnold H. Haverlee** named technical director, Fine Organics Inc., Pollution Control Chemicals Div., in Lodi, N.J.

★ **E. E. Michaels,** president of Chicago Bridge & Iron Co., proves himself a handy man with a shovel as



Mr. Michaels at work

well as with steel tanks. Here he breaks ground for the company's new general office building in Oak Brook, Ill.

★ **Charles N. Lockwood,** former sales manager, Cloroben Chemical Corp., joins Alamask Div., Rhodia, Inc., New York, manufacturers of odor control chemicals. Broadening distribution through agents will be his major responsibility at present.

★ Money will not bring friends but it does buy a better class of enemies.

NEW BACKHOE

for Oliver 550 and 770 tractors delivers 10,000 lbs. breakaway at any point down to 12¼ ft. depth. Features new, fast mounting and dismounting. Hydraulic pump powers both hoe and loader . . . allows alternate operation of either without stops to switch over.

NEW LOADER

for Oliver 550 tractor—Model 568 loader handles ½-yd. bucket . . . provides over 3700 lbs. breakout . . . will carry to 3000 lbs. It gives you power to move in, dig effectively where other rigs in class quit. Tractor features fast-reverse dual range.

NEW FORK LIFT

Oliver 551 fork lift hoists 5000 lbs. to 12-ft. height. Offers choice of 5 towers for lifts to 21 ft. Pay only for lift height you need now, trade in for higher tower when the job will pay for it. Unit combines good mobility—even in roughest footing.

For details, contact your Oliver Industrial Dealer or write to:
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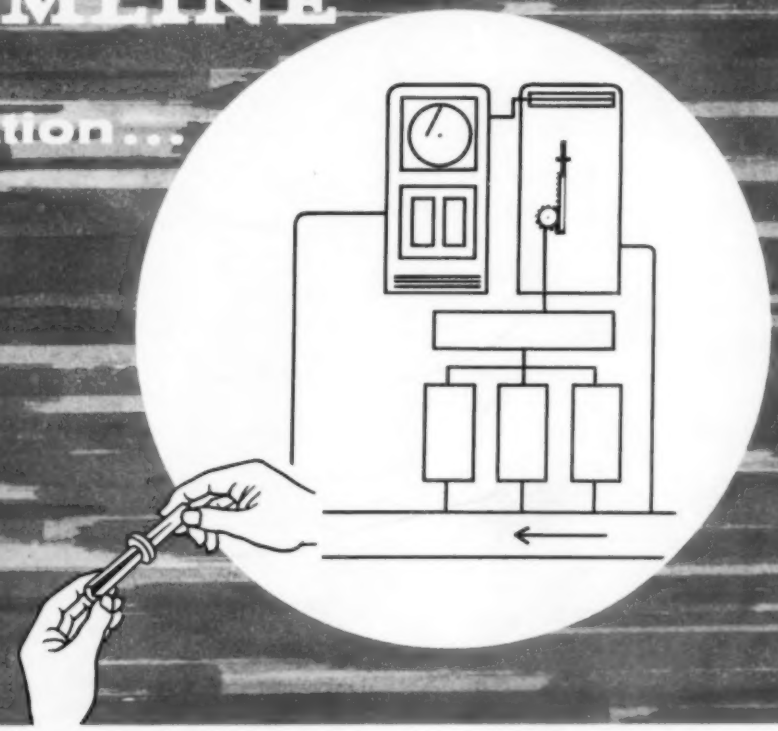

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